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The F-14 Contract: A Case Study In Major Weapon Systems Acquisition and Program Management

by

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Contracting for major weapon systems within the U.S. Government is a professional and political challenge. From the initia concept development, to the acceptance of a complete working weapon system, military acquisition professionals must balance pressure from the Executive and Legislative branches of the Government with the user's requirements. This balance must be achieved using Government generated policy and procedures as they apply to purchases from private sector corporations. A historical study of the initial F-14 acquisition will identify the distinctive problems in this type of procurement.

Success can be duplicated, and failures can be avoided by matching historical patterns of major weapon systems acquisition with current contracting requirements. Comparing the steps in the F-14 acquisition to the acquisition of any major weapon syste will provide key steps to successful future weapon systems purchases.

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ABSTRACT

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I. INTRODUCTION

A. GENERAL COMMENTS

Procurement of major military weapon systems draws much attention to itself due to the enormous amount of public tax dollars invested. Congress, news media, and public oversight are tightly focused on DOD procurements to discern the bad business decisions made in the Government's procurement business. This has created intense pressure on Government procurement executives to adapt to constant changes in procurement procedures initiated by legislative action to cure old procurement problems and endeavor to prevent future managment problems.

To understand how the DOD purchases weapons, it will be helpful to understand the simple differences between purchases in the private and military sectors. In the private sector, the purchase of an aircraft would not take place until all costs for the aircraft have been expended to completely develop and fly the aircraft that will perform the commercial application for which it was designed. In military procurement, the Government and private contractor agree on a cost before the aircraft exists, then the contractor constructs the aircraft.

The Government conducts its unique procurement business by mandating acquisition directives it hopes can flexibly respond to changes while preventing problems that have already occurred. The current system of regulations is governed by the Federal Acquisition Regulation (FAR), and the Defense Federal Acquisition Regulation Supplement (DFARS), as they specifically apply to the Department of Defense 5000.1, .2, .2M directives for major weapon systems acquisitions. The resultant changes in the current regulations were made necessary by many 1970's procurements, one of these being the F-14. By researching the dynamic changes caused by programs like the F-14 and comparing them to the standing regulations, the researcher will be able to analyze critically the current system's response to future contracts.

B. OBJECTIVE OF THE RESEARCH

The objective of this research is to perform a comprehensive historical study of the early years of the F-14 procurement, from 1962 to 1974. Emphasis will be on the researcher's interpretation of historical events compared and contrasted with current legislative requirements to discern what current requirements exist to correct previous and prevent future procurement errors. Errors made in many weapon systems procurements have common problems which can be analyzed, corrected, and applied across the board to all types of major weapon purchases. This case study will attempt to

provide lessons learned on problems that can be practically applied to future weapon systems procurements.

C. SCOPE

This thesis is a case study of the F-14 aircraft contract. The study focuses on three phases of the contract cycle beginning with the requirements determination phase and ending with the aircraft's introduction into the fleet, including original funding problems experienced by the prime contractor, Grumman.

D. RESEARCH QUESTIONS

1. The primary research question is:

What were the principal successes and failures experienced during pre-solicitation, award, and post award phases of the F-14 contract and can they be duplicated or avoided in future major weapon systems acquisitions?

Subsidiary research questions include:

2. What is involved in developing a Mission Needs Statement (MNS)?

3. What is a Mission Needs Statement and how can it lead to an effective contract?

4. What was the overall Acquisition Plan (including milestones) for this contract and to what extent did execution of the contract meet the plan?

5. What major organizations outside the Navy affected the decision to have Grumman manufacture the F-14, and how did they collaborate?

6. How should a source evaluation and selection take place compared to the F-14 evaluation and selection?

7. How were competitive decisions made during the F-14 contract?

8. What decisions adversely affected the contract administration phase of the F-14 production?

9. What ownership decisions were affected by earlier contract decisions and in what ways were they affected?

10. What are some lessons learned and aspects for major weapon systems acquisition?

E. METHODOLOGY

Preliminary research included an in-depth analysis of the contract case history. This included historical documentation detailing the Request For Proposal (RFP), the Mission Needs Statement (MNS), the contract, along with historical periodical references. In addition, existing Government regulations, orders, instructions, and policy guidance letters, were analyzed.

F. THESIS ORGANIZATION

There are six chapters in this thesis. The chapters will lead the reader through the sequence of events that took place

in the initial F-14 procurement. Historical facts are presented and developed, along with the current system of procurement, emphasizing changes and corrections that have occurred in current procurement requirements.

Chapter I is the thesis introduction.

Chapter II will present a brief background on the requirements that precipitated the development of a major weapon systems contract for a new Navy aircraft. The Navy's requirement for a new aircraft will be followed as they developed into a Mission Needs Statement.

Chapter III will introduce the political pressure present in major weapon systems acquisitions. Conflict that arose from user needs versus political goals will be explored as they pertained to the F-14 aircraft.

Chapter IV will follow the F-14 through the major weapon systems contract cycle. Contracting legislated requirements and results will be studied.

Chapter V will identify problems in the F-14 contract that were corrected by current legal requirements, policies, and directives. Problem areas that have yet to be addressed by current legislation will also be identified.

Chapter VI is the researcher's conclusions and recommendations for future weapon systems acquisitions, and further thesis research.

Appendix 1 will be a case study for use in the Acquisition and Contracting Curriculum at the Naval Postgraduate School.

Appendix 2 will be questions that a case study facilitator can use in the classroom to lead a successful class interactive examination of the case study in appendix one.

II. BACKGROUND ON MAJOR WEAPON SYSTEMS CONTRACTING

A. HISTORICAL REQUIREMENTS FOR A NEW FIGHTER

The F-14 aircraft made its debut in December of 1972, but its concept had been under development since 1950. After World War II, enemy weapon technology continued to advance, making aircraft carriers vulnerable to aircraft, cruise missiles launched form aircraft or submarines, and low flying land launched cruise missiles. The Navy had studied the Russian threat toward fleet air defense and developed a broad based requirement for a subsonic aircraft that could fire multiple missile shots at long range targets in order to defend carriers. The originally imagined aircraft was canceled by 1960 because it would only satisfy one mission. (Bright, 1992, pp. 2-9)

The original aircraft's concept as a standoff weapon was never dropped. It evolved into a multi-dimensional fighter aircraft that could defend the carrier and fulfill the dual role of offensively engaging enemy aircraft. Dual use aircraft was a change required to use the minimum amount of space on a carrier for defense while not detracting from the devastating offensive striking power that an aircraft carrier is designed to accomplish. The process of evolution begins with a broadly defined user need. The design of a new

aircraft is always an evolutionary battle to find the strongest aircraft that can survive in the current and expected threat atmosphere that a user faces in combat.

In the multi-dimensional Soviet threat environment, where an aircraft carrier can be attacked by missiles from other aircraft, ships and submarines, a single mission aircraft would not use the limited amount of space available on an aircraft carrier effectively. (Moorer, 1969, pp. 3-4) An aircraft carrier is large, but its valuable resource of space must be handled effectively. Aircraft require much more than landing and parking space. Repairs must be conducted while at sea. This requires storage for aircraft parking, living and eating space for the repair personnel and storage space for spare parts. One aircraft must satisfy more than one mission to use the space on an aircraft carrier in an effective manner. Soviet air warfare philosophy had always employed light, highly maneuverable aircraft that carry guns for close-in air battles, normally called dogfighting. If a large number of highly maneuverable Soviet aircraft attacks a carrier, there is a good chance a few could escape the Navy's "initially conceptualized stand off concept aircraft" with deadly results for the aircraft carrier. (Stevenson, pp. 6-12)

By developing a multi-mission aircraft with stand off and close-in fighting capabilities, the Navy could make maximum

use of the resources available to defeat the threat presented by Soviet aircraft.

The Navy, in the case of the F-14, and the military in general, will never be the single deciding voter in what type of weapon system is required for the United States. In our version of Democracy, decisions on spending Government funds rests with three power brokers, the Executive branch, the Legislative branch, and the Judicial branch of Government. (Bryson, 1988) The major player in the weapons decisions rests with the Executive and Legislative power brokers of which the Navy is only one Service member which gives input to the executive decision making apparatus of the President, his cabinet and appointed executives. If the Navy is going to be able to prove that it has a practical need for an aircraft, it has to get the Executive branch to support the need for that aircraft. Without the Executive branch backing up a Navy request, Congress would not have any reason to apportion and fund a procurement request. (Alexander, 1965, pp. 52-65)

The Navy was not alone in its fight for finances to field a new aircraft. Every branch of the Armed Services was also competing for Executive branch support and Congressional funding. During the time frame of the F-14 acquisition, the Air Force had successfully fielded their concept of a new fighter aircraft to meet their envisioned Soviet threat. The Navy and Air Force aircraft concepts would be required to meet in "a head to head" struggle for developmental funding

support. Both Services' concept requests for aircraft had to be reviewed by the Secretary of Defense, and then the President. President John F. Kennedy erected a major road block to both Services, and their desires for a new aircraft by appointing Robert McNamara as his Secretary of Defense in January of 1961. (Alexander, 1965, pp.245-249)

The processes by which the Navy and the Air Force indicated their aircraft performance requirements to overcome the Soviet threat had to be indicated clearly to the Executive branch of the Government. The Executive branch support was required to influence Congressional funding for a new weapon system that meets the need defined by the future users of a new aircraft. The document used to explain the Navy and Air Force needs is called a Mission Needs Statement (MNS). A MNS should be able to clearly show the Executive branch why there are differences between two Services' requirements, and the need for a unique weapon system for each Service.

B. THE IMPORTANCE OF THE MISSION NEEDS STATEMENT (MNS) AND HOW IT WAS DEVELOPED.

A major defense acquisition program is defined as a "...funded effort that is designed to provide a new or improved material capability in response to a validated need." (Department of Defense 5000.1, 1991, pp.2). In order for a weapon system user to obtain the quality and type of weapon that is desired, all the weapon system's requirements must be

insisted upon as deliverable items in the contract. An effective contract can only be written with the detailed guidance in a MNS. The MNS is the first step that defines the weapon system requirements. This mandates a carefully prepared MNS because it will become the foundation from which a contractual document is constructed.

All major weapon systems are based on identifiable mission needs. These needs are generated by assessing current and future enemy threats. In the case of the F-111B, political desires to save money forced the use of a standard aircraft for the Navy and the Air Force. (Acquisition Strategy Guide, 1984, pp.1.1-1)

A MNS evolves from a very broad user generated needs statement into system specific requirements. It is important that the proper amount of effort be expended in preparing a well planned MNS. With planning and time, the operational needs of the user will be translated into a stable and affordable program. (Department of Defense Directive 5000.1, 1991, pp.1-2 and Ch.3) Unfortunately, at the time of the initial MNS for the F-14, the Navy's MNS was over-ruled.

In the initial MNS for the F-14, managerial desires by the Executive branch over-rode user requirements, mandating a common aircraft for the Navy and the Air Force. The common aircraft (the F-111B) did not meet all the mission needs of the Navy. Both the Navy and the Air Force had specific user needs, requiring different aircraft to achieve their goals.

The trade-off between cost savings in standardization (called commonality by Secretary of Defense McNamara) and user mandated performance requirements was not made carefully enough, resulting in the manufacture of an aircraft that would never meet the flying requirements of the Navy. The justification of cost savings was politically motivated, not user generated. This does not mean that cost should not be considered in a major weapon system procurement. It does mandate a careful exploration of cost versus performance trade-offs so that a user defined need can be satisfied by the weapon system that is built. If there is not enough time, if there are any ambiguities or needs that are not specific enough, higher authority can take this into account when assessing cost versus performance trade-offs. A poorly written MNS is open to many misinterpretations that can result in higher authority being given the leeway it needs to make politically expedient decisions that do not enhance the probability of attaining the mission need a user requires in a weapon system. The F-14 MNS was complete but the Navy's mission needs were subordinated to the needs of the Secretary of Defense.

III. THE SECRETARY OF DEFENSE AND THE NAVAL AIR SYSTEMS COMMAND FULFILLING REQUIREMENTS FOR THE F-14 CONTRACT

This chapter introduces two of the major players in the approval process of a MNS. The reader needs to understand the policies and politics during the period of the F-14 contract to fully appreciate why the Navy's F-14 aircraft MNS met initial failure due to conflicting political motives and requirements.

A. ROLES PLAYED BY THE SECRETARY OF DEFENSE AND THE PROGRAM MANAGER

The Secretary of Defense (SECDEF) is appointed by the President of the United States to manage military resources. He has the power to formulate budget estimates and implement programs of a nature and kind that support and uphold the President's military and domestic policies. The SECDEF is influenced not only by Presidential policy, but also by the political needs of United States citizens through the legal and appropriation decisions imposed on the DOD weapons decisions made by the Congress of the United States. He is also responsible for interpreting and implementing Presidential policy and Congressional programs for each element of the Defense (DOD). (Acquisition Strategy Guide, 1984, pp. 1.3.1-1 through 1.3.1.-3) The criteria that guide

his managment choices are chiefly governed by political directives to implement Presidential policy. The SECDEF should also be concerned with each military department while he makes decisions based upon the needs of the President and the restrictions imposed on him by Congress.

The Program Manager (PM) is appointed by the military system commander to manage a weapon system procurement program. The PM acts as the Service branch agent responsible for planning, developing, and acquiring the weapon system that meets a user's MNS. In the F-14 contract the PM acts as NAVAIRSYSCOM's direct representative in a program. The PM must transform the mission needs statement from a concept into an operational piece of equipment. [Acquisition Strategy Guide, 1984, pp. 1.2-1 through 1.2-5] The PM must also control all the risk in four major areas as follows:

- Cost
- Schedule
- Performance
- Supportability

In the broadest sense, the PM must manage a program within budget and schedule to ensure a weapon system will perform as intended and is logistically supportable when it enters the operational user's hands. If the logistic support of spare parts, repair machinery, technical manuals and trained repair personnel are not provided for by the PM, costly contract changes will be required.

The two primary managerial decision makers in weapon systems procurement can have an adversarial relationship when it comes to developing, producing and fielding a new weapon system. The PM makes every effort to field a system that meets the user defined needs in the MNS. The SECDEF, who has full knowledge of the users MNS, must balance the scales between cost, performance, and Presidential policy. There is nothing wrong with this system; it is a natural outgrowth of the democratic checks and balances derived from the United States Constitution. The adversarial relationship will not occur as long as the SECDEF carefully considers three factors. He must consider the PM's input, select the most cost and performance worthy system and successfully meet political requirements. Breakdowns leading to adversarial problems occur when a consensus is not achievable with the information that is at hand.

If the PM does not have a clearly defined MNS from the user, the SECDEF does not have the firepower to support the development of a weapon system. In this case, the overwhelming Presidential and Congressional consensus to obtain the best cost can lead to a decision that does not favor the desires of the military user.

The other decision criterion that can break down a cost and performance effective decision comes about when the SECDEF does not listen to the user or the Congress. In this case the

SECDEF follows the Presidential policy with little consideration of the Congress, the PM, or the user's needs.

With the general roles and motivations of the SECDEF and PM explored, the reader can move on to the specific events that occurred resulting in the fielding of the F-14.

B. THE TFX PROJECT, ITS EVOLUTION INTO THE F-111

The United States Air Force (USAF) had developed its own MNS for a new aircraft at the same time as the Navy. In 1959 the USAF needed a new aircraft that could land in half the distance that its current fighters required. The USAF envisioned their aircraft having a multi-mission as an attack bomber that could fly to Europe or Asia non-stop with only one refueling. The aircraft would be able to fly at treetop level, at mach speed and deliver its nuclear weapons payload before escaping the enemy target area. This MNS went through an evolution from fixed wing to a variable swept wing aircraft that could accommodate the USAF's MNS. The wings could move from their extended position for take-offs to a deeply swept position for supersonic speed. Although a swept wing design added considerable weight to the aircraft, the Air Force saw the trade-off as negligible in comparison to the user requirements for the aircraft. (Stevenson, pp. 12-14)

The Navy's multi-mission requirements called for an attack aircraft that was heavy enough to carry stand-off missiles and maneuverable enough to engage enemy aircraft in dog fights

when necessary. The aircraft would require a long on-station fuel capacity at distances from the aircraft carrier of 200 miles or more. The aircraft had to be light enough to take off and land on a short aircraft carrier flight deck yet strong enough to withstand the violent catapult shot and arresting gear tailhook landings required on an aircraft carrier. (Configurations of the F-111A, & B Unveiled, 1964, pp. 21-22)

The Navy and the Air Force were competing to develop their MNS into a weapon system. Both Services are elements of DOD, and fall under the supervision of the SECDEF. SECDEF McNamara compared the Navy and Air Force aircraft MNSs. On the surface, the MNS of both Services seemed similar to McNamara. Both Services were seeking a fuel efficient aircraft that could remain aloft for long periods of time while carrying significant amounts of fuel and weapons. Both Service forces needed the variable swept wing system for short take offs, landings, and maneuverability in dog fights at supersonic speeds. These similarities were key to the McNamara decision on how to meet both Services' mission needs.

SECDEF McNamara entered his office with a Presidential mandate to reduce inter-service rivalry and weapon systems expenditures. There would be a great tax dollar saving if the SECDEF could curtail inter-Service rivalries which caused expensive procurements of separate weapon systems to satisfy the similar needs of two or more branches of the Armed

Services. (Alexander, 1965, pp. 89-90) The Navy and Air Force aircraft question presented McNamara with the perfect vehicle to satisfy Presidential mandate, reduce expenditures and force an end to inter-Service rivalry. McNamara decided to implement the President's agenda by requiring the Navy to use the Air Force aircraft and demonstrate the virtues of commonality of weapons in the Armed Services. McNamara's decision was that the advanced fighter version of the Navy and the Air Force would be satisfied by one aircraft, the F-111. (Kaufman, 1964, pp. 245-249)

Unfortunately for both Services, their mission needs were not really similar. The Navy required a high altitude missile and aircraft interceptor that could dog fight; the Air Force sought a bomber that could fly at supersonic speed low under enemy radar, deliver its payload and return home above enemy defenses.

SECDEF McNamara would champion his commonality cause and all the cost savings available by using one aircraft for two Services. By seeing only the similarities and not the differences in the Service's MNSs, this choice would receive the backing of the President and Congress because a common aircraft would supposedly cost less.

The common aircraft, the F-111, called for an attack computer and missile system that both Services agreed would satisfy their needs. There was no argument that a contractor could produce aircraft at a lower cost if he was building the

number of aircraft a dual Service procurement would present. Logistics costs could also be lowered through commonality. One school could be offered to both Services' technical personnel to teach them the repair and maintenance of the F-111. Spare parts could be purchased in such large numbers that their cost would be significantly lower by a dual Service procurement. McNamara considered the incompatible MNS to be outweighed by the tremendous cost savings offered in commonality.

If the Navy and Air Force had combined their forces to overcome the performance losses that would come from common aircraft, they may have had enough power to make McNamara reconsider his F-111 decision. Unfortunately, Secretary McNamara used the ancient political move of dividing and conquering opposition to the F-111 by giving the Air Force the responsibility of managing and developing the aircraft. McNamara went so far as to decree that the Air Force MNS would be compromised as little as possible to meet the Navy's need. (McNamara, 1961, pp. 1] The later decision prompted Admiral Elmo Zumwalt, the Navy's Director of Systems Analysis to say:

> The Air Force really didn't care about making the F-111 carrier capable. You could compromise the Air Force mission, somewhat, to make it carrier capable. You could not compromise the Navy mission, somewhat, and make it carrier capable. (The Buying Of The F-14, 1986, p. 2)

Secretary McNamara made another decision that somewhat placated the bad feelings the Navy had at being forced to accept an aircraft that was too heavy for carriers and failed

to meet all the Navy's needs. McNamara awarded the prime contract for the F-111 to General Dynamics while giving Grumman corporation the contract for the Navy version of the F-111 called the F-111B. McNamara knew that Navy pilots would be well supported by their long time business partners at Grumman. Grumman had built several successful generations of aircraft for the Navy. Grumman had a large number of retired Navy officers as its executives. They therefore had a great deal of sensitivity to the requirements of Navy pilots. (Coulam, 1972, pp. 244-245)

The political mandate to save money and control weapons expenditures overrode the users MNS. The result of this decision was an aircraft that did not meet all of the requirements of either Service. The trade-offs between cost savings through commonality, and user performance requirements were decided in favor of cost savings.

The Navy's F-111B began flying in May of 1965. It immediately had problems. Its engine inlets were causing stalls during flight and its excessive weight could not meet Navy requirements for carrier landings. Reports by test pilots of dangerous carrier approaches due to the windshield angle and numerous other problems kept coming from the aircraft that was supposed to meet the common needs of the Navy and Air Force. (The Buying Of The F-14, 1986, pp. 4-5)

C. THE NAVY DEVELOPS A NEW MNS, REFUTING THE NEED FOR THE F-111B

The jurisdiction for risk management rests primarily with two separate acquisition managers. The program manager is one in the role as Government representative, and the private contractor who develops the weapon system bears the other part of the responsibility for risk control. A "team" relationship is essential to the development of a new weapon. In an effort to reduce risk and avoid a problematic weapon system development program, the PM seeks the aid of the contractor who is his partner in weapon system development. (Risk Managmement, 1991, pp. 7-1 through 7-4)

The Navy openly sought cures for the F-111B's problems. The Naval Air Systems Command (NAVAIRSYSCOM) awarded contracts to McDonnell-Douglas and Grumman to evaluate the problems in the F-111B. The contractors were to determine a way to control the problems that were already discovered in the first year of test flights. These contractors were aided in their research by intelligence information gathered during a Soviet air show. The Soviets unveiled aircraft that flew higher and faster than the F-111. These new Soviet aircraft were also equipped for dogfighting, a mission need dropped by the Air Force in favor of air-to-air missile defense. (Stevenson, pp. 14-15)

Grumman's investigations found no way to improve the F-111B for the Navy. What they presented was an unsolicited proposal for a completely new aircraft. The new aircraft would keep the swept wing concept, missiles, fire control system and engines currently installed in the F-111 and put them in an airframe that was smaller and lighter by using titanium. The Grumman recommendations became known as the VFX. (Stevenson, pp. 14-15)

At the same time as the VFX concept was being designed by Grumman, SECDEF McNamara came under fire for his F-111 decision. The program costs were going up and the performance characteristics of the aircraft were going down. Television news coverage had labeled the F-111 program as a product of stubborn and incompetent management on the part of the Office of the Secretary of Defense. The American Broadcasting Company (ABC) news program had learned of Grumman's unsolicited proposal for a new aircraft and suggested it as a cost effective alternative to the botched F-111. Within days of this news broadcast, Admiral Zumwalt formed "Fighter Study Group II" to examine the technical and financial possibilities of using the VFX design if the F-111B contract was canceled.

The news media coverage alerted three other aircraft manufacturers to the Navy's desires for a new aircraft. Each of these companies submitted unsolicited proposals of their own aircraft designs to the Navy. In the midst of the

controversy, SECDEF McNamara announced his intentions to leave the Department of Defense. Four days after McNamara left office, the F-111B was canceled by the Senate Armed Services Committee in March of 1968. (Coulam, 1972, pp. 244-245)

At the start of this section the primary players in weapon systems acquisition were reported to be the SECDEF and the PM. The SECDEF was compelled by Presidential and Congressional spending policies to pursue a cost effective common weapon system at the expense the Navy's specific user mission needs. The role of the press and the American public was not mentioned. Americans can and do play an active part in the survival of a new weapon. If the will of the people can be polarized and focused on a subject, they can induce enough pressure on their Congressional representatives to change previous decisions. The galvanizing agent that turned individual and Congressional support against the F-111B was the power of the press. It is doubtful that a PM could muster the influence that was required to cancel the F-111B as quickly as the ABC news report did. Continuous failure of performance was not enough to get the SECDEF and Congress to stop funding the F-111B. It took a news report that produced popular opposition toward the F-111B to force its cancellation. The power of the press to change Congressional opinion should never be underestimated by the PM.

IV. THE EVOLUTION OF THE F-14 CONTRACT

A. REQUIREMENTS DETERMINATION

The PM is ultimately responsible for meeting program objectives. To achieve success, a PM will hold his developmental partner, the defense contractor, to the promises he made in the contract. The contractor is a team member that the PM relies upon to develop and produce a weapon system that meets the PM's requirements. As a rule, the PM must not take all contractor requirements as mandates. The PM should use the large Government infrastructure of technical, contracting, engineering and production personnel to assist him in certifying or changing contractor requirements to get the best weapon system. This attention to detail will obtain a reasonable price for both the Government and the contractor. (Major Weapon System Contracting, 1991, pp. 1-2)

Success in a weapon system acquisition will be achieved if the PM can develop an acquisition strategy at the earliest point possible to achieve his MNS and all user requirements. A successful acquisition strategy comprises the objectives and goals to achieve technical, performance and resource risk managment addressed in the MNS. The strategy will also serve as a road map to assist in trade-off decisions necessary to

balance system cost with performance requirements. (Acquisition Strategy Guide, 1984, pp. 1.5-1 through 1.5-8)

The acquisition plan goes much further then defining only the weapon systems requirements. Requirements for contract type and contractor incentives are addressed in the acquisition plan. Also, communications with contractors can be addressed to ensure all competitors receive the same information so as not to assist any one contractor more than the other contractors. The evaluation criteria for competitors are also laid out to assist in decision making and lay the course required to successfully procure a new weapon system.

The PM draws assistance in the management task from many sources. The Contracting Officer (CO) will assist the PM in interpreting his requirements into contract terminology. The CO can prevent ambiguity. This will in turn assist the contractor in his performance of the exact task required to achieve all the PM's requirements and successfully complete the contract.

Up to this point, the Navy aircraft systems command had relied on the support of the F-111B PM to represent the Navy's view point. Anticipating the cancellation of the F-111B program, NAVAIRSYSCOM established a program office for a follow-on aircraft to the F-111B. This step was necessary to reduce NAVAIR's acute sense of urgency over the fact that they

had wasted six years in the F-111B procurement program. (Moorer, 1969, pp. 15-16)

The MNS was well-developed. The F-111B had helped in the requirements determination for a new fighter. The F-111B information, combined with the Grumman unsolicited proposal, was essential to the remarkably fast time in which the Navy's Request For Proposal (RFP) was written. By the time the Senate Appropriations Committee approved funds for the new aircraft, the Navy's program office had its RFP ready to submit for contractor competition. The normal four month approval period for an RFP had been reduced to only 10 days. (Moorer, 1969, pp. 15)

The requirements in the RFP were very similar to Grumman's original proposal. The requirements included:

1. Two Pratt & Whitney TF-30 engines, essentially the same as in the F-111.
2. The AWG-9 weapon system with Phoenix missiles that is basically the same as in the F-111.
3. A two-man crew, seated front and rear, narrowing the fuselage and lessening drag.
4. Have the capacity to carry six Phoenix missiles or combinations of several other missiles and one internal M-61A 20mm cannon. The cannon gave the aircraft the dogfighting capability the Navy wanted.
5. Carrier take-off and landing requirements.

(U.S. Congress, Part 3, 91st Congress, 1st Session, 1969, pp. 354-355)

B. THE SOLICITATION PROCESS

The solicitation phase begins when the approved RFP is released for defense contractors to view. Competition is desired because it is the best way to keep defense contractors from maximizing profits at the Government's expense. The Government will solicit as many qualified firms as possible.

The RFP is funded initially to solicit contractors and advertise weapon systems requirements. Initial RFPs can also clarify the weapon system requirements. While the RFP's needs and concepts are being clarified and explored, the possibility exists for lowering the aircraft cost and obtaining a better weapon system for the Government through competition.

During the solicitation phase, bidders' conferences can be held to further clarify contract requirements. This bidder conference communication process should be fair to all contractors and not lend assistance to any one contractor.

Five contractors responded to the RFP released to contractors on June 21, 1968. Five one million dollar definition contracts went out to Ling Temco Vought, Grumman, McDonnell-Douglas, General Dynamics, and North American Rockwell with a required proposal submission date of October 1, 1968. (Stevenson, pp. 15)

Four of the five contractors proposed a swept wing design. The low cost proposal design was so long it raised concern about parking space on board a carrier. All the contractors were allowed a wide variety of communication with the program office with the ability to withdraw a proposal and work on it some more if desired. Each contractor's design looked increasingly similar to each other as a result of their program office communications. If the RFP had continued any longer, it may have been hard to tell the difference between each of the contractors offers. (The Buying Of The F-14, 1986, pp. 6)

C. EVALUATION AND SELECTION

The program manger evaluates the inputs from contract managers in response to his RFP. His procurement and source selection plans are now used to select qualified contractors.

To prevent showing favoritism, the source evaluation criteria should be flexible enough so as not to exclude any one contractor's ideas. The most often used critera evaluate:

- Whether the contractors' proposals effectively meet the MNS.
- Cost of development should be compared, along with Life Cycle Costs (LCC).
- Manning and training requirements.
- Spare part support and what level of reliability is expected.
- Maintainability and supportability in the fleet.

- Safety requirements.
- Contractor's past performance.
- Contractor's facilities are evaluated. Are they adequate or can they become adequate?
- Contractor's technical capabilities and production requirements.
- Contractor's management skills and expertise.

These criteria should lead to the selection of a contractor who can give the Government its best value for the money. The list of selection criteria is not all inclusive. Other criteria specific to a certain weapon system contract can be added to adequately define how to choose the best contractor. Cost should never be the only criterion considered in the acquisition of a major weapon system. Quality of system and best value do not always come at the lowest price. Best value encompasses technical superiority and should lower the risk of producing a weapon. The PM should use as many selection criteria as necessary to obtain a weapon that will meet the Navy's needs. (Federal Acquisition Regulation, 1990, pp. 15.603-605)

Competition should continue to be emphasized after the initial RFP. There is no requirement to narrow the field of responding contractors to one during the first selection process. Restricting the competitive field to the best two or three contractors should take place. The initially funded contractors should be limited to those with the best proposals that can meet the Government's requirements. The final

competitors will be funded for further contract exploration and final selection of a winning contractor.

The initial field of five contractors for the F-14 contract was narrowed down to two competitors by January 5 of 1969. The two finalists were Grumman Aerospace, and McDonnell-Douglas.

The Grumman version initially cost much more than the McDonnell-Douglas aircraft. Grumman originally submitted a quotation of $2,781,950,100. Their modified submission included two kinds of changes for a price reduction of $326,300,000. For the first change, Grumman lowered the ceiling price of the aircraft by $362.3 million. The second change involved reallocating $112.1 million of general and administrative costs on equipment and parts that were furnished by the Government. This change redistributed some of its overhead costs to other corporate activities. Grumman indicated that this accounting change was recommended by the Department of Defense. (The Buying Of The F-14, 1986. pp. 6) After a little more cost shaving was done, the new Grumman proposal stood at $2,419,950,100 compared to McDonnell-Douglas's proposed cost of $2,319,422,000, a difference of $100,528,100. The difference is quite large but when compared in scope to the total contract price and other evaluation criteria, it was small enough to give Grumman the contract.

The Defense Department announced that Grumman had won the contract on January 14, 1969. There was no opposition at any stage in the Navy's internal review process. The Navy's Source Selection Advisory Council had reached a unanimous decision based on Grumman's past performance, their substantial technical and operational superiority, their lesser development risk, and greater potential. (Stevenson, pp. 15) The Grumman basic fighter design was superior to the McDonnell-Douglas aircraft in terms of speed, climb and maneuverability. The advisory council believed the risk associated with the new McDonnell-Douglas aircraft could require major re-design and increase cost while prolonging the delivery schedule. Cost was not the major decision making factor. McDonnell-Douglas' ceiling prices were five percent lower than Grumman's and target costs were almost identical. When the Navy compared its independent cost estimate for the F-14 to the contract price, it appeared that the Navy saved $472,950,000 with its competition plan. (U.S. Congress, Part 3, 91st Congress, 1st Session, 1969 pp. 355-357)

D. THE CONTRACT

The contract is the legal basis on which the Government and contractor relationship and responsibilities are delineated. It should define all the contractor's responsibilities in terms of what is necessary for delivery and completion of each contractually agreed upon feature.

Industry is relied on for development and production of a weapon system. The contract will provide for control and direction of the contractor's efforts in weapon development. The terms of the contract will provide all monitoring efforts that a contractor has agreed to so that the PM will have all the information necessary to make sound weapon systems trade-off decisions to obtain the system required by the user in as economical and effective manner possible.

PMs cannot surrender any of their surveillance requirements to the defense contractor via the contract. All surveillance performed by Civil Servants, must be performed by them and no one else. To prevent this, the PM has technically competent engineering, production and contracting personnel to assist in the decision making process.

The contract will specify the contract type to achieve the plans made in the acquisition plan. There are two broad contract types. They are fixed-price and cost-reimbursement contracts. Each type of contract has its own desired applications to fairly reimburse a contractor for the level of risk he has undertaken in the contract.

A fixed-price contract is normally used to place the maximum financial risk upon the contractor. The contractor assumes full responsibility in the form of profits and losses for all costs under or over the contractually agreed to price for delivery of the weapon system to the Government. This in turn gives the contractor maximum incentive to control

contract costs and protect his profit. (Acquisition Strategy Guide, 1984, pp. 3.6-1 through 3.6-2)

Cost-reimbursement contracts were used from World War II up through the early 1960's. The contractor was paid for all costs incurred while developing the program for production. The contractor is expected to give the best effort to stay within the bid cost but is not incentivised by any contractual agreement to do so. The contractor is better off when inefficient because he will be paid all costs he incurs. (Acquisition Strategy Guide, 1984, pp. 3.6-1 through 3.6-2)

In the case of the F-14 contract, a refinement on the fixed-price contact was chosen because the contractor and the Government felt there was a lower risk in developing the F-14. The-Fixed-Price-Incentive-Firm (FPIF) contract was used. It is a fixed-price contact with a provision to adjust the profit and establish a final contract price by a formula based upon the relationship between the final negotiated total cost of the contract and the total target cost established in the original contract. The following elements are negotiated in the original FPIF contract:

- Target cost of the contract.
- Target profit the contractor expects to generate upon completion of the contract.
- Ceiling Price the Government will pay for the system being developed.
- A share ratio to determine the final profit and price.

After performance of the contract, the final contract price is established in accordance with the formula. When the final cost is more than the target cost the result is a final profit less than the target profit or even a net loss to the contractor. (Federal Acquisition Regulation, 1990, pp. 16.401 through 16.403.1 and DFARS Ref. 216.402). The contractor assumes a considerable amount of risk and is incentivised to control his costs to prevent losses of his own profits. (Incentives In Contracts, 1989, pp. 1-26)

The following description of incentives and Multi-Year Procurements in Government contracting may prove to be remedial to Government contractors. The information is inserted to give non-contracting personnel an insight into how the Government tries to motivate private contractors by controlling the requirements delineated in a Government contract.

Incentives in contracts are used to adjust risk between the Government and the contractor. Incentives used properly will increase the amount of cooperation between the Government and the contractor. Incentives motivate contractors to increase their cost consciousness, technical certainty and certain performance goals dictated in the contract's weapon system performance requirements. (Acquisition Strategy Guide, 1984, pp. 3.7-1 through 3.7-6)

Incentives can have disadvantages. The administrative cost to the Government can be increased because the Government

must assess whether the incentives are achieving their desired goals. Both the Government and the contractor have a difficult time in establishing realistic cost targets. Changes to the original contract inevitably result in cost increases. If the contractor is not solely motivated by profit, the Government is placed in a risky position of accepting cost increases because they have fewer ways to incentivise a company not motivated by profit.

Another element influencing the contract is the length of the procurement. A Multi-Year Procurement (MYP) gives the contractor funding stability. A defense contractor can commit to buy expensive tools and materials in high quantities to reduce costs. Labor can be managed and utilized efficiently because a dependable cash flow is present. In many cases the contractor commits to improve his plant and manufacturing process because he knows he can rely on a certain amount of business from the Government over a long period of time. (Acquisition Strategy Guide, 1984, pp. 3.2-3 through 3.2-4)

There are disadvantages to MYP contracts. If the Government cancels a contract, it will incur very high costs from the contractor. Inflation and unstable markets can make original price and cost elements become totally invalid over time. This risk of inflation increases in direct proportion to the length of the MYP.

Schedule risk can be controlled with a good contract. Time is money, and schedules control the amount of money

spent. A good contract will develop a schedule in consensus with the contractor that allows full system development. Full development occurs when all elements of the weapons development program are scheduled with enough time to complete each item. The interrelationships are tight in order to spend the right amount on each element. Schedules can prevent or make problems. If two or more elements of a schedule are dependent upon each other, the change of schedule for one item will affect the start date of another item. When more than one interdependent item is scheduled at the same time, the items are called concurrently scheduled items. (Risk Management, 1991, pp 3-6 through 3-7) Concurrent scheduling can reduce schedule risk but greatly increase performance risk if a completion date slips. Slipping completion dates can affect all the other dependent items awaiting the completion of a dependent item. The schedule is largely a joint call made by the contractor and the PM. Small errors in scheduling can be overcome; large errors may require major contract changes and cost the Government more money then originally planned for.

If risk can be controlled by the contract, a program should prove to be successful. Risk can occur in many different areas of weapon production. For example, if a new aircraft is surpassing the current state of the art, there is a high degree of development risk for the contractor. In this case the Government would have to pay the contractor for his

risk by utilizing a cost type contract. If there is not a requirement to surpass the state of the art, the developmental risk is lower. A different contract with incentives can be used. Equitable risk sharing by way of a written contract is essential to the success of a weapons program. (Risk Managment, 1991, pp 3-6 through 3-12)

With the above introductory information, it will be easier to see why the Government chose an FPIF contract structure for the F-14 procurement. It will also lead to an understanding of where the contactor did and did not properly assess the level of risk involved in the contract. This erroneous risk assessment reinforced political pressure against the F-14 procurement.

Contract negotiations between Grumman and the Navy went quickly due to their long history of non-adversarial relations. A Fixed-Price-Incentive-Firm (FPIF) contract type was chosen. This was a variant of the Total Package Procurement (TPP) strategy developed by Secretary of Defense Robert McNamara. (The Buying Of The F-14, 1986, pp. 26) This contracting strategy was designed to stop the cost overruns that had plagued development projects of the 1950's and 60's due to the use of cost type contracts. The older system, called cost plus, allowed for the payment of direct costs for overhead, plus an additional percentage as a fee or profit which incentivised contractors to increase expenses to make

more money. (U.S. Congress, Part 3, 93rd Congress, 1st Session, 1973, pp. 409)

The TPP and FPIF strategy was designed to contain expenditures by minimizing cost and technical risk. The Government would pay a fixed-price in advance for a set number of units over a set number of years. The contract was to run for eight years. If the contractor's expenses fell below a fixed-price, they would make increased profits. If Grumman exceeded the fixed-price, they could not turn to the Government for financial relief; they would have to absorb the loss. In this way, it was envisioned by the Government that Grumman would be encouraged to make a realistic bid based on factual data concerning their overhead expenses and on careful inflation predictions over the life of the contract. It also allowed the Government some flexibility in rate procurement. (U.S. Congress, Part 7, 92nd Congress, 2nd Session, 1972, pp. 1115-1121)

TPP was advantageous for Grumman because it simplified financial reporting requirements that the Government requires of the contractor. TPP forced the contractor to make prudent business decisions to avoid cost increases. The Government had less of a requirement to oversee Grumman, presenting Grumman with a hands-off attitude in TPP. (Coulam, 1972, pp. 379-384) This was possible because Grumman assumed all the risk for cost control, allowing less Government scrutiny of

corporate financial records. (U.S. Congress, 91st Congress, 1st Session, Report No. 91-468, 1969. pp. 19-20)

The first year's production of Lot I aircraft was designated for research and development. Grumman was to begin full production after Lot I. The number of aircraft to be produced was undefined at the outset of the contract. In 1968, NAVAIRSYSCOM had forecast the purchase of 1,400 aircraft. By the time the contract was signed on February 3, 1969, the original forecast had been scaled down without setting a firm number of purchases. A median number of purchases were set for the first eight years. The Navy could determine the actual quantity for each year's production one year in advance, and notify Grumman of the decision through the annual contract discussions. (The Buying Of The F-14, 1986, pp. 8)

To keep the F-14 from gaining weight during development, a lesson learned from the F-111, the contract included incentives for maintaining the contracted agreement for maximum aircraft weight. The contract specified a target weight and rewarded Grumman to keep the new aircraft light. Forty of the sixty points of selection critera available were for incentive payments dependent on keeping the F-14 aircraft weight as low as possible. The other twenty points were used to enforce maintainability, cost control, approach speed, and acceleration time to altitude. (Moorer, 1969, pp. 24-26)

The Fixed-Price-Incentive-Firm (FPIF) contract specified a first year target price and ceiling price for the aircraft. If Grumman hit the target price it could make a ten percent profit on its expenses. For every additional expense over the target price, the company would pay the additional expense while the Government would pay a decreasing share of the costs. The ceiling price, or maximum amount Grumman could collect each year, was set at 125% of the target price for every year after the first year. The ceiling price would remain the same for eight years no matter what actual quantity of aircraft was procured. (Stevenson, pp. 25)

The ceiling price Grumman could charge was designed to be immovable throughout the duration of the contract. This requirement was put into the contract due to tough Congressional price control requirements aimed at military contractors. Grumman's ceiling prices were based on a thorough statistical study of the cost of production already experienced and documented by United States aircraft manufacturers in the 1950's and 60's. Grumman studied Bureau Of Labor Statistics figures for preceding years and based their projected inflation rates on these figures. The rate was set at two percent per year on materials and three percent on labor. (U.S. Congress, Part 7, 92nd Congress, 2nd Session, 1972, pp. 300-309) No other special adjustments for inflation were to be permitted until the negotiations for Lot VI in fiscal year 1974.

The contract did allow cost changes that arose from evolution of the design of the F-14 during production. Changes originated by the Navy (or from modifications to Government Furnished Equipment (GFE) supplied by the Navy) could be billed to the contract. Changes that Grumman initiated on its own would require Grumman to absorb the costs. The contract timelines were strict. The pressure to make up for the lost years in the F-111 generated a requirement to produce the F-14 in 24 months. To speed the process further, Navy testing and evaluation of the F-14 was not scheduled to begin until the aircraft was in production. The concurrent scheduling would require any changes made as a result of the test flights to be retrofitted onto existing aircraft. (Harmon, 1989, pp. 49)

The procurement of the F-14 provided Grumman with other compensation for activities and expenses beyond the cost of manufacturing. Tooling costs would be paid over the second and third year of the contract with target and ceiling prices set in advance. Due to the significant capital investment required for titanium fabrication, this amount of money was significant to Grumman. The capability to subcontract titanium work was not excluded from the contract. (The Buying Of The F-14, 1986, pp. 8)

Overhead costs were computed by using records Grumman had of its recent business base and its current total manufacturing activity. The percentage of corporate overhead

billed to the F-14 would be roughly proportional to the size of that contract compared to Grumman's total volume of business. Quantities were unspecified for spare parts, training and support materials. They would be negotiated year by year as the Navy's needs became clearer. (The Buying Of The F-14, 1986, pp. 9)

The prime contractor, Grumman, was responsible for design, production and assembly of the aircraft. The Navy would supply Pratt & Whitney engines, Hughes Aircraft avionics systems and the Phoenix missile system as Government Furnished Equipment (GFE) sub-assemblies. (U.S. Congress, Part 5, 91st Congress, 2nd Session, 1970 pp. 1120)

Pratt & Whitney had to adapt their TF-30 engine used in the F-111 for use in the F-14. The TF-30 engine was full of troubles so the Naval Air Systems Command required Pratt & Whitney to develop a new version after the first sixty-six aircraft were delivered. The Navy looked for two alternatives to power the F-14 after the first sixty-six aircraft. One option was to wait for a short time until a joint U.S. Air Force/ Navy advanced technology engine was ready for service in 1972. In addition, the Navy commissioned Pratt & Whitney to develop a new higher-powered engine that would give the F-14 the power its creators had anticipated. This engine was to be ready by 1974. The decision not to wait for a proven engine was made because the Navy believed it needed aircraft now and any additional delay waiting for engines was deemed

unacceptable. (U.S. Congress, Part 5, 91st Congress, 2nd Session, 1970, pp. 1125-1131)

Grumman made subcontractor agreements for the parts and subassemblies that were not provided as GFE. Between August 1968 and January 1969, Grumman had identified potential subcontractors and used their price quotes as a basis to prepare their final bid for the Government. In February of 1969 when Grumman signed the contract with the Navy, they had not concluded any binding agreements on prices or quantities with its subcontractors. (The Buying Of The F-14, 1986, pp. 9)

Grumman had lowered its bid considerably from its original cost estimates to win the F-14 contract. By September of 1969, only nine months after the F-14 award announcement, Grumman started indicating to the Navy that their cost figures may have been inaccurate. This news was precipitated by an overall change in the aerospace market and was met with Congressional concern. (U.S. Congress, Part 5, 92nd Congress, 1st Session 1970. pp. 438-444)

In the 1970's, the aerospace industrial base was declining. Defense spending had significantly reduced after Viet Nam. Grumman produced the Navy's A-6E attack aircraft, the E-2C early warning aircraft and the E-A6B electronic warfare aircraft. Each one of these procurements were reduced. The pride of Grumman, the NASA contract for the Apollo lunar lander was the other big contract Grumman

depended on to support its business base. After the United States placed a man on the moon, the contract from NASA was drastically reduced below forecasted levels. The down turn in production levels happened at the same time that aircraft work pay rates shot much higher than Grumman's projections for the F-14 program.

Inflation rates were projected to be two percent per year for the first five years of the F-14 program. According to Bureau of Labor Statistics, these forecasts were well below actual figures. (U.S. Congress, Part 5, 91st Congress, 2nd Session, 1970, pp. 1120)

Table I: GRUMMANS PREDICTED INFLATION RATES V.S. ACTUALS

YEAR	GRUMMAN MATERIAL FORECAST	GRUMMAN LABOR FORECAST	ACTUAL INFLATION INCREASE
1969	100	100	100
1970	102	10●	105.9
197●	104	106	110.5
1972	106.1	109.2	114.1
1973	108.2	112.6	121.2
1974	110.4	115.9	134.5

Source: The Buying Of The F-14, 1986, pp. 18

To further compound matters, the contract did not allow for abnormal escalation controls to be implemented until 1973. (U.S. Congress, Part 5, 92nd Congress 1st Session, 1971, pp. 438-440)

In September 1969, seven months after signing the F-14 contract, Grumman's president told the Navy he was concerned over contractual commitments as far as Lot IV and all subsequent lots. In July of 1970, Grumman communicated fears of financial difficulties after examining the severe economic impact of the changing aerospace business base structure. The Total Procurement Package (TPP) concept was becoming unfeasible based on the cuts in the defense spending and economic conditions. (U.S. Congress, Part 5, 92nd Congress, 1st Session, 1971, pp. 439-440)

The president of Grumman communicated these same fears to NAVAIR in January of 1971. During this visit to Washington D.C., he stressed that the price ceiling was so low that Grumman was unable to deliver F-14s at the contractually agreed to price. (U.S. Congress, Part 5, 92nd Congress, 1st Session, 1971, pp. 440) A NAVAIR pricing team visited Grumman to substantiate Grumman's concerns. The team discovered that Grumman had taken steps to reduce their overhead by reducing their employment totals from 31,500 in 1969, to 25,300 in 1971. They also reduced their physical plant facilities by 630,000 square feet. (U.S. Congress, Part 5, 92nd Congress, 1st Session, 1971, pp. 442) Grumman was in trouble and

capable of seeking relief under Public Law 85-804, Extraordinary Contract Relief. This law allowed a contractor who was being driven out of business by their Government contract to receive Government help. The help would be in terms of lengthening performance time in a contract, receiving advance payments, amendments in Grumman's favor without consideration to the Government, and just about anything to keep Grumman, a necessary Government contractor, financially afloat. (Sherman, 1991, pp. 63) Grumman did not seek Government relief. The reasons for not seeking relief at this time are known only to the Grumman executives who made the decision. In July of 1971, the Deputy Secretary of Defense, David Packard, requested that Grumman commit to the production of fourty-eight aircraft for Lot IV, if Congress authorized and appropriated the funding. Grumman committed to build the aircraft at a loss on 27 July 1971.

The F-14 experienced developmental problems during its test flight program. In December of 1970, just twenty-three months after the contract was awarded, the F-14 prototype crashed unexpectedly. This happened at a critical time period when the Navy needed successful test results to bolster Congressional support for the F-14. The crash highlighted the Navy's bad decision to speed up the procurement of the F-14 by deliberately overlapping testing and production. Before the crash there was early Congressional Appropriations' Committee

concern about the F-14 program. In December Congressional feelings were:

> It is the considered of the Committee that the Navy is moving too fast into production of the F-14 aircraft. The Committee does not share Navy optimism...that the F-14 aircraft represents a low risk program. (U.S. Congress, Part 3, 91st Congress, 2nd Session, 1969, pp. 315)

Original schedules called for the production of sixty-six aircraft before the Navy's final tests were completed. With the crash, the aircraft produced before testing would cost more due to an expensive retro-fit requirement on all previously built aircraft to prevent further crashes. Back fit programs like these are thought of by Congress as schemes to "get well" as far as contract costs are concerned.

Congressional upheaval over the F-14 program arose quickly fueled by early skepticism toward the Navy's low risk assessment of the F-14 contract. Congressmen raised the possibility that Grumman's final bid may have been deliberately pegged below their real estimates on the assumption that prices could be raised once the contract was signed. Senators Mark Hatfield and William Proximire attacked the program, going so far as to propose closing the F-14 line and using modified F-4 Phantoms until another aircraft could be developed. Their objections to the program were further fueled by the problems the F-14 was having with its TF-30 engines. In order to shorten procurement lead time, TF-30 engines from the F-111 program were used in F-14 production.

These engines were only to be installed in the first sixty-six F-14s until Pratt & Whitney delivered a new engine in 1970 that would meet the original power and thrust requirements the Navy had contracted for. Pratt & Whitney never did develop a more powerful engine. This made the Navy increase the number of aircraft to be equipped with the less satisfactory TF-30 engine. This further fueled the objections of Senators Hatfield and Proxmire. Even the F-14's staunchest advocates had to admit that this change seriously compromised the F-14's performance. Fortunately for the F-14 program, funding was not stopped. Deputy Secretary of Defense Packard had learned his lesson about concurrent development and testing and initiated his "fly-before-you-buy" program, (Seamans, 1972, pp. 62) preventing future programs from going into the production phase before final testing of the prototype was complete.

One major career casualty did result from the technical scheduling and risk mistakes that took place. The program manager, Captain Lionel Ames, was replaced by Captain Leonard A. Snead. The F-14 program would continue in the face of Congressional opposition.

On 5 December 1972, the Office of the Secretary of Defense (OSD) Program Budget Decision reduced the fiscal year programmed procurement of F-14s from eighty-eight to fourty-eight aircraft. This purchase under Lot V was received by Grumman with a refusal to honor the existing contract without

a price increase. Grumman said they had lost $85 million on the program already and would lose $105 million more if they did not get a contract price adjustment.

In similar contract disputes, the Pentagon had acceded to contractor demands by rewriting the contract completely or ordering system modifications that increased the contract price. In the case of the F-14, the Navy was denied this kind of choice. Congressional pressures had mandated only enough money for the purchase of fourty-eight aircraft according to original contract prices. (U.S. Congress, Part 3, 91st Congress, 2nd Session, 1969, pp. 554) The Defense Department was forced to announce it would hold Grumman to the originally contracted price on December 11, 1972.

There was support that countered the opposition for the F-14 in Congress. A Congressional bailout of Grumman was being maneuvered in the House and the Senate by the New York representatives. New York Senators Javits and Buckley announced on the 13th of December 1972, that they would propose legislation in 1973 to permit Grumman, of Bethpage, New York, a higher price for F-14s. Similar action would be forthcoming from the four New York Congressmen Grover, Leat, Wydler and Roncallo. President Nixon was supportive of the move to assist Grumman.

Following intensive negotiations between Grumman and the Navy, Grumman agreed to produce the fourty-eight aircraft in Lot V at the originally contracted price provided Congress

authorized and appropriated necessary funding for a new contract in fiscal year 1974. (U.S. Congress, Part, 3, 93rd Congress, 1st Session, 1973, pp. 93)

The F-14's cost in constant 1969 dollars when the program began was $9.7 million per aircraft. Changes in the contract were authorized after Lot V, which led eventually to F-14 costs escalating to $17.9 million per unit by 1981. (The Buying Of The F-14, 1986, pp. 14-16)

The new F-14 program manager, Captain Leonard Snead, countered Congressional critics and started building support for the program with an aggressive public relations program. Every time the Congress would try another ploy to kill the program, the program manager would make a ten minute film showing off the aircraft's many attributes. Senator Proxmire continued his assertions that the F-14 was nothing more than a "Gold Plated" mistake that should be canceled. The battle continued but the bottom line was the Navy began accepting delivery of F-14s. The Navy had its new generation aircraft for fleet protection.

The F-14 PM and his program office had learned some hard but valuable lessons while procuring the F-14. The failure of the F-111B presented the lesson that a common aircraft is only feasible when Services fulfill common war taskings. If there is no common task, a common weapon system should be avoided. The PM office lost its first PM learning that concurrent scheduling of test flights during production can have costly

back fit results caused by rushing into production before testing is complete. They also learned how important the media is to the failure or success of a weapon system.

These lessons learned were limited to aircraft procurements by the Navy. The Navy had learned some lessons but every branch of the Armed Services had learned lessons during this time frame. Some of the lessons were very similar, others were Service unique. None of these lessons learned were combined on an inter-Service level to prevent their occurrence in future programs until the late 1980's. This combining effort is the topic in the proceeding chapters of this thesis.

V. PROBLEM IDENTIFICATION AND ANALYSIS

The historical facts of the F-14 acquisition have been presented. When comparing the historical acquisition of the F-14 with the present day procurement policies, try to comprehend how problems that occur in the procurement of the of the F-14 have affected current procurement procedures. It is not as easy to discern weaknesses in the new procurement policy structure; these will be pointed out individually.

A. THE CURRENT SYSTEM OF MAJOR WEAPON SYSTEMS CONTRACTING

The DOD 5000.1, .2, and .2M series of directives were written in 1991 to establish "a disciplined management approach for acquiring systems and material that satisfy the operational user's needs." The system was set up for uniform application to all DOD elements. Stability and affordability of a weapon system program are also addressed with the goal of satisfying the user's needs.

The system is designed to make broad based long range investments based on future fiscal resources. To facilitate these future investment decisions, the management structure of the DOD was streamlined, defined and shortened to assign responsibility for tracking of procurements.

Initially a broad mission need is checked to see if it can be satisfied without a new item being procured. If a simple

doctrine or training change can satisfy the mission, there is no need to procure a new item. The Under Secretary of Defense for Acquisition (USD(A)) and his decision support infrastructure will consider all materials that already exist in the following hierarchy to see if they can satisfy the mission need before a new start weapon program is authorized:

- (1) Use or modification of existing military system.
- (2) Use or modification of a commercial or allied system.
- (3) Can cooperative research with other Allied Nations produce a new system.
- (4) Is there already a joint DOD Service program being developed that will satisfy the user's needs.
- (5) When all above have been considered, a new start Service-unique development program will be looked into.

(DOD Instruction 5000.2, 1991, pp. 3-11)

Once a new start has been approved, the broad requirements of the user will evolve into a system specific description that will satisfy a unique set of requirements and satisfy the user's needs. (DOD Instruction 5000.2, 1991, pp. 1-5)

Risk managment is addressed through all phases of a contract by the Government Program Manager (PM) and the contractor. Factors such as design to cost, life cycle costs, schedule, maintenance support, and concurrent engineering are all used to lower risk, cost, and increase operability, maintainability, produciability and reliability in weapon systems procurement. (Risk Managment, 1991, pp. 2-1 through 4-13)

Competition is mandated to be used to the maximum extent possible. Competition will assist in feasibility studies of alternate weapon systems to meet user needs.

Testing of weapon systems requires the establishment of a testing activity that cannot be influenced by weapon systems PMs. This averts the possibility of falsification of test results by a weapon program advocate to ensure continued procurements for a weapon system.

The acquisition cycle is set up in five basic phases:

- Phase 0: For Concept Exploration, Definition, and Evaluation.
- Phase I: For Demonstration and Evaluation.
- Phase II: For Engineering and Manufacturing Development.
- Phase III: For Production and Development.
- Phase IV: Operations and Support.

Each phase is separated by a Milestone meeting. To exit from one phase and enter the next, certain performance critera must be satisfied as well as other considerations. If the criteria cannot be met, the program will stop, meet the criteria, or possibly face cancellation. (Cochrane, 1991, pp. 1-3)

A program cannot enter the first phase of procurement without meeting Milestone 0's, (Concept Studies and Awards Approval) requirement to have a Mission Needs Statement (MNS). This MNS must document a mission need to correct a war fighting deficiency. A MNS is required on all programs

requiring new start material solutions. (DOD Instruction 5000.1, 1991, pp. 2-2 through 2-5)

A MNS must meet the Milestone 0 exit criteria adjudged as valid by the Under Secretary Of Defense for Acquisition (USD(A)) and his decision making support infrastructure. He will determine if a Defense Acquisition Board (DAB) should convene. The DAB will evaluate funding competitive contractors for the most probable solutions to solving a MNS and give their recommendations to the USD(A). In the hope of fostering competition, multiple contractor awards for concept studies will be approved during Phase 0, (Concept Exploration, Definition and Evaluation).

Before continuing on, it will be helpful to understand how the DAB gives its recommendations for approval or disapproval and what other support resources it draws on to make that decision. A MNS will be written by the Military Department and submitted to the Joint Requirements Oversight Counsel (JROC). The JROC is made up of senior military commanders from all branches of the Armed Services and chaired by the Vice Chairman of the Joint Chiefs of Staff. They are required to determine if the mission need is valid and assign the valid MNS a priority that will assist the USD(A) in determining when he should convene a DAB. (DOD Instruction 5000.2, 1991, pp. 3-2 through 3-5)

The USD(A) will be the final decision making authority in approving a program. This person will use the inputs of the

JROC and the DAB to assist him in his decision. The DAB is composed of Senior Civilian Acquisition Executives (SAE's). The DAB is led by the Under Secretary of Defense for Acquisition, two Defense Under Secretaries from the Pentagon and other testing, evaluation and appropriation advisory groups. They are assisted by three standing committees:

- Strategic Committee
- Command Control and Communications Committee
- Conventional Systems Committee

The DAB will have the input from the JROC to assist in writing their recommendations. (DOD Instruction, 5000.2, 1991, pp. 13-A-1 through 13-A-4)

The USD(A) will make a decision based on the inputs of the JROC and the DAB. If the USD(A) approves the MNS he will do it with a document called an Acquisition Decision Memorandum (ADM). The ADM will list a minimum set of the alternative concepts to meet the MNS. It will choose the number of concept study contracts to be awarded, designate the lead study organization and evaluate a dollar amount for further funding studies. An ADM does not appropriate money. The ADM will also establish the exit criterion that must be met to pass the next milestone approval at Milestone I. (DOD Instruction 5000.2, 1991, pp. 3-9 through 3-12)

The next important document generated in Phase 0 of the acquisition process is the Operational Requirements Document (ORD). It will be submitted along with the MNS to the

milestone evaluation DAB at Milestone zero. The ORD will document the performance and related operational parameters proposed for each new system that was funded for concept exploration, evaluation and definition. It will also assess logistics support requirements and criteria that serve as further exit criteria from Milestone zero. The ORD will be updated after each milestone to be more specific in its requirements. (DOD Instruction 5000.2, 1991, pp. 4-B-1 through 4-B-2)

The entire milestone review process for each milestone should take a period of one hundred and eighty days, or six months. Remember that a milestone review must take place before entering each of the next four phases (Phase 0 through Phase III- Phase IV is not discussed in this thesis). Each milestone review has a required document list that will answer the questions asked by the DAB and Congressional Committees that would address risk control. The required plans on the document list are: (Cochrane, 1991, pp. 8)

- Acquisition Plan
- Configuration Management Plan
- Computer Resources Life Cycle Management Plan
- Human Systems Integration Plan
- Integrated Logistics Support Plan
- Manufacturing Plan
- Program Protection Plan
- Software Development Plan

- Systems Engineering Management Plan
- Technology Assessment and Control Plan
- Test and Evaluation Master Plan
- Training Development Plan

All of these plans will try to control the risk associated in each area. The scope and formality of these plans can be tailored to each individual acquisition. It will not be necessary to go into each of these plans for this thesis.

B. THE HISTORICAL PROCUREMENT PROCESS FOLLOWED IN PURCHASING THE F-14 FELL SHORT OF CURRENT LEGALLY DOCUMENTED PROCUREMENT PROCEDURES AND PRACTICES.

The general policies for acquiring weapon systems have changed very little from 1969 to 1993. Satisfying the users needs by using a new system when common systems do not meet mission requirements is as possible now as it was in 1969. Life cycle costs and risk control have always been examined in order to make the best performance vs. cost trade-off possible for a weapon system. The critical failures of past acquisitions lie in the fact that there was not a "disciplined" management approach to procurements. The techniques and policies are similar but the application of these techniques was left totally to the acquisition managers discretion. With this identification of the major difference between past and current procedures in mind, identification of

the F-14 procurements shortfalls when compared to current procedures can be understood.

Time frames are strictly defined and observed for the submission and review of evidence pertaining to production approval for a new weapon system. In the current system, it takes two years to advance through the approval meetings from Milestone 0, (Concept Studies and Awards Approval) through Phases 0, I, and II before Milestone III is reached, (Production Approval). The F-14 program had an aircraft in the air in two years. This would make the older system used in 1969 seem more efficient because of its fast paced production. While it is true that the Navy had its new aircraft airborne in two years, the question of achieving the performance requirements originally desired must be reviewed. The Navy accepted the F-14 with the TF-30 engine brought over from the F-111B program. The Navy did not like this under-powered engine from the beginning. That is why the original contract called for it to be installed in the first sixty-six aircraft only! After that, a new engine would be installed to meet the required flight performance requirements desired in the 1969 contract requirements. It is now 1993, the TF-30 engine was installed in almost all of the F-14 aircraft that were manufactured over its twenty-four year life span. It is the researcher's conjecture that the accelerated performance trade off in favor of a quicker production schedule would not have been made so quickly if the F-14 procurement had occurred

under current DOD 5000.2 time frame requirements. At a minimum the F-14 production would have been drawn out two extra years for a total of four years from signing the contract to production of the aircraft, simply by following current DAB time requirements. This minimum could easily become longer because the aircraft was unsuccessful at meeting its performance criteria and would have been unable to pass through Milestone II, (Development Approval.) The researcher is not saying that the perceived Soviet threat would not have eventually outweighed the originally contracted engine performance requirements and result in a performance requirement waiver. The researcher does believe that waiting for mandated time frames would have pressured Pratt and Whitney, and possibly the Air Forces dual use aircraft engine program, to produce a more acceptable engine in a quicker time frame. Perhaps the already fielded British modification to the F-4 Phantom could have been procured to bridge the gap for a slower F-14 procurement, resulting in the Navy getting all of the engine performance it wanted.

The strict milestone review process would have further slowed the F-14 procurement until the contractor could deliver a better performing engine. The new process involves a joint military and DOD civilian decision process. Involvement of a joint military determination in the JROC at each milestone would have been another slowing point in the production approval of the F-14. The Navy made and justified performance

trade-offs that it refused to make in the F-111B program with the Air Force. It is the researcher's belief that the Navy accepted more performance trade-offs in the F-14 program than it had to make in the F-111B program. The reason the F-14 performance trade-offs were easier to accept was because the F-14 was the Navy's baby from conception to maturity. The injection of another Service being the leader in the F-111B made it much more difficult for the Navy to get performance trade-offs approved. The JROC will naturally slow down the approval process of a weapon program, once again pressuring the contractor to improve engine performance in a shorter amount of time.

The next step in the decision process is the DAB. The JROC input is not authority to precede with a procurement. They merely validate the mission need, and prioritize it for input to the DAB. The DAB is chaired by the USD(A) and two other Service Secretaries who are assisted by testing, evaluation and acquisition specialists. The civilian Secretaries would need political pressure and a very convincing argument to approve the performance trade-offs required in using the TF-30 engine in the F-14. These executives may not even be from the Navy. The lack of empathy presented by a non-Navy DAB Secretary would further slow the acquisition process down and force the Navy to wait to get what they originally asked for in the F-14 contract.

Ultimately, the signature authority decision falls to USD(A). He is appointed to this position because he is a skilled management practitioner from the private sector who may or may not have a military background. He may elect to make the performance trade-offs but time would ultimately have been added on to the procurement process.

To this point, only the performance trade-off in the TF-30 engine has been considered. There is a cursory list on page fifty-four of this thesis that should be understood and used as guidance at each milestone decision point. The Integrated Logistics Support Plan (ILSP) addressed the lifetime requirements of a weapon system in terms of the training, manpower, level of spares and level of maintenance required to keep an aircraft like the F-14 continuously available for use, once delivered to the Navy. Interviews conducted with Navy maintenance and Supply Corps personnel document the perceived failure of the ILSP for the F-14. Many items that could prevent an F-14 from flying were items that could not be repaired by the Navy. These items reduced available flight time of the F-14. Other items took a very long time to transfer into the Navy stock system, indicating a lack of planning for anything more than an expedited two year delivery of an aircraft. These logistics support problems tarnished the superlative performance of the F-14. (Interview, 1993) When the aircraft was flying, even with its performance degradations, there were few people who would not defend the

positive fighting capabilities the F-14 gave to the Navy. The F-14's opponents complaints came in the well supported arguments that the F-14 aircraft was hard to keep airborne due to supply and logistics support problems with spares, computers, and software incorporated into the F-14. Once again, this is only one example of an incomplete planning effort that was not addressed in 1969 but would be forced to be addressed by the new weapon systems acquisition system delineated in the DOD 5000 series requirements.

Failure to successfully justify trade-offs in any one of the currently mandated plans addressed on paged fifty-four would be grounds for stopping progress on the production of the F-14 in todays disciplined management approach to acquiring a weapon system. The researcher believes that the production approval of the F-14 would have been delayed if it were forced to obtain the same milestone approvals required of todays weapon procurements. The delays would have happened in Phase II (Engineering and Manufacturing Development.) The researcher also believes that the political and adversarial pressure presented by the Soviets would have prevented cancellation of the F-14. The end result would have delivered to the Navy an even better product at a later date then the Navy stipulated in their original contract.

C. THE F-14 HISTORY INDICATES THAT CURRENT PROCEDURAL REQUIREMENTS HAVE NO LARGE PROBLEM AREAS.

The disciplined management approach currently required by the DOD 5000 series does not mean that the new system is inflexible. Each section of the DOD 5000 procurement series stresses that managers are not forced to follow every directive as long as deviations are properly justified as good business decisions. The leeway for exercising authority within this disciplined approach will still give direction but it does prevent the use of complete flexibility.

Complete flexibility as practiced during the F-14 procurement put an aircraft in the sky in only two years. The drawback was that spare parts reliability, maintainability and aircraft performance problems plagued the F-14 throughout its service life. The disciplined management approach requires consideration of building an aircraft in the quickest possible time while stressing system performance reliability and maintainability issues to prevent problems in the years the aircraft will be operated by the fleet.

The principal author of the DOD 5000 series emphasizes its ability to change in response to changes in the procurement environment. Changes are not required due to the flexibility built into the series. The rules are general guidelines that can change by applying common sense to the required procurement framework. (Fedorochko, 1992, pp. 18-19)

The current procurement system draws heavily upon the 1986 blueprint for change laid out by Deputy Defense Secretary David Packard. As now implemented, the reformed system applies equally to all branches of the Armed Service. Consistency and simplicity streamlined the older procurement system in which each Service had a different set of procurement rules to follow.

Possible additions to the DOD 5000 series could be made in procurement areas not originally put into the series. Areas such as international programs and commercially based pilot programs should be addressed to be effective in the upcoming years of diminished defense dollars for procurements in order to sustain the industrial base. (Fedorochko, 1992, pp. 19)

The cultural changes required by the DOD 5000 series can prove important in the future years of dwindling defense spending. Joint weapon programs are now stressed where there once was too much inter-Service rivalry to think of this option. This is not saying that inter-Service rivalries have disappeared but the corner stone for cooperation amongst the Services has been laid. Services now recognize that it is in their best interests to work with, not compete with, the other Services to get more results with less money.

The DOD 5000 series requires no large changes. Additions can apply it to any situation not previously covered in the initial directives. The fundamental principles of discipline and responsibility must remain unchanged. With all Services

processing procurements in a consistent fashion, the defense department and the industrial base now have a unified establishment working under the same basic guidelines.

VI CONCLUSIONS AND RECOMMENDATIONS FOR FURTHER RESEARCH

A. JROC SCREENING FOR MNS VALIDATION

The failure of the F-111B acquisition demonstrates the inadequacies in joint weapon systems that existed prior to the DOD 5000 series. The Armed Forces were competing against one another for funds and procured separate weapon systems with vastly differing procurement methodologies. The uniformity and discipline that exist now will be important to a down sizing DOD.

Important paradigm shifts are underway making joint program consideration important to military Services. The JROC embodies the new cultural shift in weapon procurement. The vice chiefs of each branch of the military jointly review every weapon systems Mission Needs Statement (MNS). From the initial approval of the MNS to the final approval to go into production, joint military programs are considered and promoted fairly across each department of the Armed Services. The JROC distributes a proposed MNS for a major program to all Service combatant leaders to solicit the viewpoint of the weapon systems users. After all of these inputs are reviewed along with all the possible alternatives, the JROC will have completed it's job in validating the MNS before it is forwarded for DAB input and ultimately USD(A) approval. The

longer the JROC and the new DOD 5000 series is around, the better each Service will become in utilizing the shrinking budget tax dollars available in the near future.

B. PROBLEMS ASSOCIATED WITH ACCELERATING THE ACQUISITION DECISION PROCESS

Before the DOD 5000 series, weapon systems were not so constrained by calendar schedules for approval milestone meetings. While this did lead to a shorter lead time in fielding an aircraft, it also lent itself to easily overlooking life cycle, maintainability and reliability costs which ultimately can degrade a weapon systems performance.

Quick procurements are still possible but they are constrained form overlooking everything except fielding an aircraft. Each milestone event requires the use of a set of procurement plans designed to address all elements of a system life cycle costs. The DOD 5000 series rules and schedules are the most effective controls of risk implemented to date.

Uniformity, discipline and definition of responsibility are essential to ensuring that the best business decisions are made during a weapon procurement. By disallowing too much acceleration of the procurement process, a better product is purchased for the lowest possible life time cost considerations.

C. RISK AVOIDANCE WITH PROTOTYPE MANUFACTURING

Prototype aircraft development is now required and is a part of the "fly-before-you-buy" concept developed during the F-14 procurement. An Institute For Defense Analysis (IDA) paper studied the procurement time frames for nine aircraft including the F-14 and the F-111. Programs using prototypes took 11.5% less time to go into development then non-prototype programs. Schedule risk is reduced with prototypes.

Many programs choose not to use prototype development in their weapon systems procurement. A waiver for use of prototypes can be granted by the USD(A) if it can be shown that a prototype will not be cost effective. The program manager can submit waiver requests with proof showing that the time savings using a prototype does not give enough of a cost saving to warrant the use of a prototype. If the USD(A) believes that a prototype is not cost effective, he will waive the requirement and send the waiver to Congress for thirty days. If there is no challenge from Congress, the waiver is approved and the prototype will not be required. (Establishing Competitive Production Sources, 1984, Ch-16)

The use or non-use of prototypes is the DOD 5000 series' flexible response to time versus cost trade-off decisions. The decision is made early in a programs life to take full advantage of the decision no matter what decision is made. Risk is thus effectively avoided by a common sense business decision.

D. COMPETITION DECISIONS THAT COULD HAVE HELPED THE PROGRAM

The new DOD 5000 series requires the effective use of competition throughout every phase of a weapon systems development. The requirement for competition should be built into the initial acquisition plan and indicated to the contractors via the Request for Proposal (RFP).

The F-14 program had suitable competition for the airframe but failed to stress it in the subsystems category for the F-14's engines. The TF-30 engines from the F-111 program were suppose to be replaced by an upgrade of the current contractors engine or a dual use engine provided by the Air Force.

Competition should have forced the two engine contractors to adopt production efficiencies to produce a high quality responsive aircraft engine. The competition was not really present in the contract for the F-14. The results of the lack of competition was the Navy's continued use of the under powered TF-30 engine throughout the contract because neither competing company felt the pressures to develop a new engine on time.

The DOD 5000 series mandates competition for purchase of the best performing system. It is competition in the keenest sense of the word. The vehicle that could have been used in the F-14 contract was a Form-Fit-and-Function competition that is currently described in the series. Two contractors would be encouraged to differentiate their final product as long as

it worked in the F-14 airframe. The use of a performance specification would compel contractors to develop separate engines that could compete and show a clear winner in terms of performance, reliability and maintainability. The DOD 5000 series competition goes from the aircraft to sub systems such as engines, radars, or any system where competition will acquire the best value for the money spent.

E. FURTHER RESEARCH

Further research into the F-14 acquisition should prove to benefit the acquisition and Contract Management curriculum at the Navy Postgraduate School. The F-14 is one of the newest contracting examples of the acquisition process that can be tracked form its creation to its cancellation. This thesis covers only five years of a dynamic weapon systems program that covered over twenty five years. Follow on case studies will enrich thesis students and the acquisition curriculum.

APPENDIX A (TOMCAT ACQUISITION CASE STUDY)

TOMCAT ACQUISITION

THE INITIAL YEARS OF THE F-14 STORY

It is a late night in 1968. Your top Naval aviation warfare specialists are trying to define a new aircraft that will be the best all-around fighter in the United States inventory. What capabilities does the new aircraft need to possess? What other areas are of concern besides aircraft performance and how can it be produced in the most cost effective manner? As you ponder these questions your mind scans back twenty to thirty years to assist you in your determination.

Protection of the Navy's highest value unit, the aircraft carrier, has been a priority for the United States Navy since World War II. Navy battle groups were designed to protect aircraft carriers which can make devastating offensive strikes on the enemy. As enemy weapon technology advanced, aircraft carriers became vulnerable to Russian air attacks, both from missiles launched from aircraft and from low flying cruise missiles. This led to an increased number of aircraft being devoted to defending the carrier itself.[Ref. 1]

In the 1960's, the primary protective aircraft for the U.S. Navy was the F-4. The aircraft was liked by the pilots who flew them but it lacked a gun and restricted the pilot's vision; both of these factors are a primary requirement for aerial combat or dogfighting. These restrictive factors contributed to the high aircraft loss rate during the Viet Nam War. Navy planners sought a new generation of aircraft that could protect itself and the aircraft carrier.[Ref. 2]

This new generation aircraft would need to be able to intercept and engage Russian targets using air-to-air missiles and using dogfighting tactics when necessary to prevent the Russians from launching their cruise missiles at United States carriers. The aircraft had to be powerful enough to carry air-to-air missiles yet light enough to take off and land on a carrier. A new aircraft would require the strength to survive carrier catapulted takeoffs and the violent landings or controlled crashes that Navy pilots experience during carrier operations. The capability of staying on station, awaiting attackers at 200 miles or more from the carrier while using fuel effectively to stay at this distant station for several hours, was another important requirement.

The Navy's solution to meet its mission met much political opposition during the Kennedy administration. Kennedy's Secretary of Defense, Robert McNamara, was determined to reduce inter-Service rivalries. Inter-Service fights often led to separate purchases of costly systems to meet similar

inter-Service mission needs.[Ref. 3] One of Secretary McNamara's most hotly contested political issues was his goal to reduce rivalry among the military Services. McNamara's first action to attain his goal was to require the Navy to share the same aircraft with the Air Force, who was also in the market for a new fighter and bomber. McNamara believed a joint project would show the virtues and savings represented by inter-Service commonality.[Ref. 4]

The Air Force's mission statement had some commonality with the Navy's. Both Services were seeking a fuel efficient aircraft capable of remaining airborne for long periods while carrying significant amounts of weight in fuel and weaponry. The Air Force was extremely interested in an aircraft design that would reduce their dependency on long, easily attackable airstrips, duplicating the Navy's requirement for an aircraft that could take off and land on a short field. Unfortunately, not all the mission needs were similar. While the Navy needed a high altitude missile interceptor that could dogfight, the Air Force sought a bomber that could fly fast under enemy radar and drop nuclear weapon ordinance in hostile territory.[Ref. 5]

The Air Force design had already taken shape in the form of the variable swept wing F-111. Their long swept wing configuration was particularly adaptable to the common mission need for short take offs and landings. In the short swept wing mode, the F-111 was capable of flying long-distance

flights at supersonic speeds. With Secretary of Defense McNamara's approval, the Navy was virtually forced to accept an aircraft that was too heavy for carriers and did not meet all the Navy's needs.[Ref. 6] Major modifications were denied to the Navy because McNamara stated the Air Force aircraft was to be compromised as little as possible to meet the Navy's needs.[Ref. 7]

Secretary McNamara intervened in the contracting process, awarding General Dynamics the prime contract while giving Grumman the contract for both the airframe and the assembly work on the Navy version of the F-111.[Ref. 8] The Navy got some consolation from McNamara's selection of Grumman. Grumman had built several successful generations of Navy aircraft. Grumman's active recruitment of retired U.S. Navy Officers as executives gave them a great deal of sensitivity to the combat requirements of Navy pilots.

The design and construction phase of the F-111 did not proceed smoothly. Stories were circulated in the Pentagon that the Navy, opposed to the aircraft and unable to block it, was obstructing construction progress. Unsubstantiated reports credited the Navy with proposing dysfunctional design features, requesting expensive modifications, making reports of safety problems and delaying carrier trials, while leaking unfavorable stories to the press.[Ref. 9] The Navy was openly seeking alternatives to the F-111 during its design and construction. In 1965, the Naval Air Systems Command

(NAVAIRSYSCOM) awarded contracts for $1,750,000 to Grumman and McDonnell-Douglas to evaluate the F-111 and consider options. Grumman, the proud designer of so many Navy aircraft, took this job seriously by examining over 3,000 different ideas for new aircraft.[Ref. 10]

Test results on the F-111 in 1966 and 1967 were unsatisfactory in the areas of high altitude performance. Further ammunition against the F-111 took shape during a Soviet Union air show in 1967.[Ref. 11] The Soviets unveiled new fighter aircraft that flew higher and faster than the F-111. The new Soviet aircraft were also designed for dogfighting, a mission need dropped by the Air Force in favor of air-to-air missiles. Grumman took into consideration the Soviet aircraft and the Navy's overall displeasure with the F-111 program during their F-111 effectiveness study.

Grumman's F-111 assessment was presented to the Deputy Chief of Naval Operations, Admiral Thomas Connolly, in October 1967. The company president, Mr. Lew Evans, led the Grumman presentation team that included another chief company executive, their chief designer, and Joe Rees, a retired Naval officer who served with Admiral Connolly. They evaluated the F-111's inability to fulfill the Navy's need for a missile interceptor that was also capable of close combat. Grumman went a gigantic step further by presenting an unsolicited proposal for a new, lighter, more agile aircraft. [Ref. 12] This aircraft would not have bombay doors

like the F-111, making it a better fighter. It would retain the F-111's Phoenix missiles, avionics capabilities, the TF-30 engines, and a modified variable sweep wing. None of the innovations proposed would try to surpass the current state of the art. Lighter materials, such as titanium, would be used to make this new aircraft's weight and strength compatible with Navy aircraft carrier operational requirements. An upgraded version of the F-111 weapon system, the AWG-9, could select targets for the simultaneous firing of six Phoenix missiles, while continuing to scan for other enemy traffic. Evans argued it would cost no more to produce this new aircraft than it would to continue development of the Navy's version of the F-111. The Navy immediately formed a fighter study group to technically evaluate the Grumman technical and financial proposal and the financial implications of closing down the F-111 program.[Ref. 13]

Three other aircraft manufacturers heard of Grumman's unsolicited proposal and submitted unsolicited proposals of their own. In the midst of all the F-111 controversy, Secretary McNamara, the leading supporter of commonality and the F-111, announced his intentions to leave the Department of Defense. In April of 1968, the Senate officially voted to discontinue the Navy version of the F-111 aircraft. [Ref. 14]

NAVAIRSYSCOM had anticipated the cancellation of the F-111 program by establishing a program office for their follow on

version of the F-111. Navy Captain Lionel Ames was selected as the program manager. The NAVAIR sense of urgency was acute, they believed that six years had been wasted in the procurement of the F-111. Captain Ames personally carried procurement documents to the various DOD Secretaries and Congressional members for their approval. By the time the Senate Appropriations' Committee approved funds for the new aircraft, the program office had a Request for Proposal (RFP) ready to submit to contractors. The normal six month period for approval of an RFP was reduced to ten days. [Ref. 15]

The requirements in the RFP were very similar to Grumman's original proposal. The requirements included: [Ref. 16]

1. Two Pratt & Whitney TF 30 engines, basically the same as in the F-111.
2. The AWG-9 weapon system with Phoenix missiles, that are basically the same as in the F-111.
3. Two-man crew, seated front and rear, narrowing the fuselage and lessening drag.
4. Have the capacity to carry six Phoenix missiles, or combinations of several other missiles and one internal M-61A 20mm cannon. The cannon gave the aircraft the dogfighting capability the Navy wanted.
5. Carrier take off and landing requirements.

Five contractors responded to the RFP released to contractors on June 21, 1968. Five one million dollar definition contracts went out to Ling Temco Vought, Grumman, McDonnell-Douglas, General Dynamics, and North American Rockwell with a required proposal submission date of October 1, 1968.[Ref. 17]

Four of the five contractors proposed a swept wing design. The low cost proposal design was so long it raised concern about parking space problems onboard a carrier. All the contractors were allowed a wide variety of communication with the program office with the ability to withdraw a proposal and work on it some more if desired. Each contractor's design looked increasingly similar to each other as a result of their program office communications. If the RFP had continued any longer, it may have been hard to tell the difference between each of the contractors offers. [Ref. 18]

On December 15, 1968, the Defense Department made a news release that the competition had been reduced to Grumman and McDonnell-Douglas. The two finalists were to prepare and submit their final proposals by January 5, 1969. [Ref. 19]

The Grumman version initially cost much more than the McDonnell-Douglas aircraft. Grumman originally submitted a quotation of $2,781,950,100. Their modified submission included two kinds of changes for a price reduction of $326,300,000. For the first change, Grumman lowered the

ceiling prices of the aircraft by $362.3 million. The second change involved reallocating $112.1 million of general and administrative costs on equipment and parts that were furnished by the Government. This change redistributed some of its overhead costs to other corporate activities. Grumman indicated that this accounting change was recommended to them by the Department of Defense. [Ref. 20] After a little more cost shaving was done, the new Grumman proposal stood at $2,419,950,100 compared to McDonnell-Douglas's proposed cost of $2,319,422,000, a difference of only $100,528,100.

The Department of Defense announced that Grumman had won the contract on January 14, 1969. There was no opposition at any stage in the Navy's internal review process. The Navy's Source Selection Advisory Council had reached a unanimous decision based on Grumman's past performance, their substantial technical and operational superiority, their lesser development risk, and greater potential. [Ref. 21] The Grumman basic fighter design was superior to the McDonnell-Douglas' aircraft in terms of speed, climb and maneuverability. Risk on new development in the McDonnell-Douglas aircraft could cause major re-design, and increase cost while prolonging the delivery schedule. Cost was not the major decision making factor. McDonnell-Douglas ceiling prices were five percent lower than Grumman's, and target costs were almost identical. When the Navy compared

its independent cost estimate for the F-14 to the contractually agreed to price, it appeared that the Navy saved $472,950,000 with its competition plan.[Ref. 22]

Contract negotiations between Grumman and the Navy went quickly due to their long history of non adversarial relations. A Fixed-Price-Incentive-Firm (FPIF) contract type was chosen. This was a variant of the Total Package Procurement (TPP) strategy developed by Secretary of Defense Robert McNamara. This contracting strategy was designed to stop the cost overruns that had plagued development projects of the 1950's and 60's due to the use of cost plus a percentage of cost contracts.[Ref. 23] The older system allowed for the payment of direct costs for overhead, plus an additional percentage as a fee, or profit, which incentivised contractors to increase expenses to make more money.[Ref. 24]

The TPP and FPIF strategy was designed to contain expenditures by minimizing cost and technical risk. The Government would pay a fixed-price in advance for a set number of units over a set number of years. The contract was to run for eight years. If the contractor's expenses fell below fixed-price, they would make increased profits. If Grumman exceeded the fixed-price, they could not turn to the Government for financial relief; they would have to absorb the loss. In this way, it was envisioned by the Government that Grumman would be incentivised to make a realistic bid based on

good data concerning their overhead expenses and on careful inflation predictions over the life of the contract. It also allowed the government some flexibility in rate procurement.[Ref. 25]

TPP had an advantage for Grumman because it simplified financial reporting requirements. TPP forced the contractor to make prudent business decisions to avoid cost increases. The Government had less of a requirement to oversee Grumman, presenting Grumman with a hands-off attitude in TPP.[Ref. 26] This was because Grumman had all the risk for cost control so there was not as great of a reason for close Government scrutiny of corporate financial records.[Ref. 27]

The first year's production of Lot I aircraft was designated for research and development. Grumman was to begin full production after Lot I. The number of aircraft to be produced was undefined at the outset of the contract. In 1968 NAVAIRSYSCOM had forecast the purchase of 1,400 aircraft. By the time the contract was signed on February 3, 1969, the original forecast had been scaled down without setting a firm number of purchases. A median number of purchases were set for the first eight years. The Navy could determine the actual quantity for each year's production one year in advance and notify Grumman in the annual contract discussions. This variable lot contract is summarized in Table I on the next page. [Ref. 28]

RANGE OF QUANTITIES UNDER VARIABLE LOT CONTRACT				
LOT	FISCAL YEAR	MINIMUM	MEDIAN	MAXIMUM
1	69	--	6	--
2	70	3	6	9
3	71	15	30	45
4	72	48	96	144
5	73	48	96	144
6	74	15	96	144
7	75	48	96	144

Source: Buying of the F-14

To keep the F-14 from gaining weight during development, a lesson learned from the F-111, the contract included incentives for maintaining the contracted agreement for maximum aircraft weight. The contract specified a target weight and rewarded Grumman to keep the new aircraft light. Forty of the sixty points of selection criterion available

were for incentive payments dependent on keeping aircraft weight as low as possible.

The Fixed-Price-Incentive-Firm (FPIF) contract specified a first year target price and ceiling price for the aircraft. If Grumman hit the target price it could make a ten percent profit on its expenses. For every additional expense over the target price, the company would pay the additional expense while the Government would pay a decreasing share of the costs. The ceiling price, or maximum amount Grumman could collect each year, was set at 125% of the target price for every year after the first year. The ceiling price would remain the same for every year, no matter what actual quantity of aircraft was procured.[Ref. 29]

The ceiling price Grumman could charge was designed to be immovable throughout the duration of the contract. This requirement was put into the contract due to tough Congressional pressure against military contractors to hold down costs. Grumman studied the Bureau Of Labor Statistics figures for preceding years and based their projected inflation rates on these figures. The rate was set at two percent per year on materials and three percent on labor.[Ref. 30] No other special adjustments for inflation were to be permitted until the negotiations for Lot VI in fiscal year 1974.

The contract did allow cost changes that arose from design evolution during F-14 production. Changes originated by the

Navy (or from modifications to Government Furnished Equipment (GFE) supplied by the Navy) could be billed to the contract. Changes that Grumman initiated on its own, would require the corporation to absorb the costs. The contract timelines were strict. The pressure to make up for the lost years in the F-111 generated a requirement to produce the F-14 in twenty-four months. To speed the process up further, Navy testing and evaluation of the F-14 was not scheduled to begin until the aircraft was in production. Any changes made as a result of the tests would be retrofitted onto existing aircraft. [Ref. 31]

The procurement of the F-14 provided Grumman with other compensation for activities and expenses beyond the cost of manufacturing. Tooling costs would be paid for over the second and third year of the contract with target and ceiling prices set in advance. Due to the significant capital investment required for titanium fabrication this amount of money was significant to Grumman. The capability to subcontract titanium work was not excluded from the contract.[Ref. 32]

Overhead costs were computed by using records Grumman had of its recent business base and its current total manufacturing activity. The percentage of corporate overhead billed to the F-14 would be roughly proportional to the size of that contract compared to Grumman's total volume of business. Quantities were unspecified for spare parts,

training and support materials. They would be negotiated year by year as the Navy's needs became clearer.[Ref. 33]

The prime contractor, Grumman, was responsible for design, production and assembly of the aircraft. The Navy would supply Pratt & Whitney engines, Hughes Aircraft avionics systems and the Phoenix missile system as Government Furnished Equipment (GFE) sub-assemblies.[Ref. 34]

Pratt & Whitney had to adapt the TF-30 engine used in the F-111 for use in the F-14. The TF-30 engine was full of troubles so NAVAIRSYSCOM required Pratt & Whitney to develop a new version after the first sixty-six aircraft. The Navy looked for two alternatives to power the F-14 after the first sixty-six aircraft. One option was to wait for a short time until a joint U.S. Air Force/ Navy advanced technology engine was ready for Service in 1972. In addition, the second option involved the Navy's commissioning of Pratt & Whitney to develop a new higher-powered engine that would give the F-14 the power its creators had anticipated. This engine was to be ready by 1974. The decision not to wait until a proven engine was ready was made because the Navy needed aircraft and any additional delay waiting for engines was deemed unacceptable. [Ref. 35]

Grumman made subcontractor agreements for the parts and subassemblies that were not provided as GFE. Between August 1968 and January 1969, Grumman had identified potential subcontractors and used their price quotes as a basis to

prepare their final bid for the Government. In February of 1969, when Grumman signed the contract with the Navy, they had not concluded any binding agreements on prices or quantities with its subcontractors.

Grumman had lowered its bid considerably from its original cost estimates to win the F-14 contract. By September of 1969, only nine months after the F-14 award announcement, Grumman started indicating to the Navy that their cost figures may have been inadequate. This news was precipitated by an overall change in the aerospace market and was met with Congressional concern.[Ref. 36]

In the 1970's, the aerospace industrial base was declining. Defense spending had significantly reduced after Viet Nam. Grumman produced the Navy's A-6E attack aircraft, the E-2C early warning aircraft and the E-A6B electronic warfare aircraft. Each one of these procurements was reduced significantly. The pride of Grumman, the NASA contract for the Apollo lunar lander, was the other big contract it depended on to support its business base. After the United States placed a man on the moon, the contract from NASA was drastically reduced below forecasted levels. The down turn in production levels happened at the same time as aircraft work pay rates shot up to much higher levels than Grumman's initial projections for the F-14 program.

Inflation rates were projected to be two percent per year for the first five years of the F-14 program. According to

Bureau of Labor statistics, these forecasts were well below actual figures. See Table II [Ref. 37]

GRUMMANS PREDICTED INFLATION RATES V.S. ACTUALS

YEAR	GRUMMAN MATERIAL FORECAST	GRUMMAN LABOR FORECAST	ACTUAL INFLATION INCREASE
1969	100	100	100
1970	10●	10●	105.9
1971	104	106	110.5
1972	106.1	109.2	114.1
1973	108.2	112.6	121.2
1974	110.4	115.9	134.5

Source: Buying of the F-14

To further compound matters, the contract did not allow for abnormal escalation controls to be implemented until LOT V in 1973.[Ref. 38]

In September 1969, seven months after signing the F-14 contract, Grumman's president told the Navy he was concerned over contractual commitments as far as Lot IV and all subsequent lots. In July of 1970, Grumman communicated fears of financial difficulties after examining the severe economic

impact of the changing aerospace business. The Total Procurement Package (TPP) concept was becoming impossible based on the cuts in the Defense spending and economic conditions.[Ref. 39]

The president of Grumman communicated these same fears to NAVAIRSYSCOM in January of 1971. During this visit to Washington D.C., he stressed that the price ceiling was so low that Grumman was unable to deliver F-14s at that price.[Ref. 40] A NAVAIRSYSCOM pricing team visited Grumman to substantiate their concerns. The team discovered that Grumman had taken steps to reduce their overhead by reducing their employment totals from 31,500 in 1969 to 25,300 in 1971. They also reduced their physical plant facilities by 630,000 square feet.[Ref. 41]

Grumman was in trouble and capable of seeking relief under Public Law 85-804, Extraordinary Contract Relief. This law could allow a contractor who was being driven out of business by their Government contract to receive help in terms of lengthening performance time in a contract or other assistance necessary to keep essential Government contractors like Grumman in business.[Ref. 42] Grumman did not seek Government relief. In July of 1971, the Deputy Secretary of Defense David Packard requested Grumman commit to the production of fourty-eight aircraft for Lot IV if Congress authorized and appropriated the funding. Grumman committed to build the aircraft at a loss on 27 July 1971.

The F-14 was having problems in the areas of cost and technology. In December of 1970, just twenty three months after the contract was awarded, the F-14 prototype crashed unexpectedly. The Navy had sped up the procurement of the F-14. This required the Navy and Grumman to deliberately overlap testing and production. Before the crash there was early Congressional Appropriation Committee concern about the F-14 program. In December Congressional feelings were:

> It is the considered judgment of the Committee that the Navy is moving too fast into production of the F-14 aircraft. The Committee does not share Navy optimism...that the F-14 aircraft represents a low risk program.[Ref. 43]

Original schedules called for the production of about sixty-six aircraft before the Navy's final tests were completed. After the crash, the aircraft produced before testing would cost more due to an expensive back fit requirement on all aircraft built before the crash to prevent further crashes. Back fit programs like these are thought of by Congress as schemes to "get well" as far as contract costs are concerned.

Congressional upheaval to the F-14 program arose quickly fueled by their early skepticism toward the Navy's low risk assessment of the F-14 contract. Congressmen raised the possibility that Grumman's final bid may have been

deliberately pegged below their real estimates on the assumption that prices could be raised once the contract was signed. Senators Mark Hatfield and William Proximire attacked the program, going so far as to propose closing the F-14 line and using modified F-4 Phantoms until another aircraft could be developed. Their objections to the program were further fueled by the problems the F-14 was having with it's TF-30 engines. In order to shorten procurement lead time, TF-30 engines from the F-111 program were used in F-14 production. These engines were only to be installed in the first sixty-six F-14s until Pratt & Whitney delivered a new engine in 1970 that would meet the original power and thrust requirements the Navy had contracted for. Pratt & Whitney never did develop a more powerful engine. This made the Navy increase the number of aircraft to be equipped with the less satisfactory TF-30 engine. This further fueled the objections of Senators Hatfield and Proxmire. Even the F-14's staunchest advocates had to admit that this change seriously compromised the F-14's performance. Fortunately for the F-14 program, funding was not stopped. Deputy Secretary of Defense Packard had learned his lesson about concurrent development and testing and initiated his "fly-before-you-buy" program,[Ref. 44] preventing future programs from going into the production phase before final testing of the prototype was complete.

One career officer became a casualty as a result of the technical scheduling and risk mistakes that took place. The program manager, Captain Lionel Ames, was replace by Captain Leonard A. Snead. The F-14 program would continue in the face of Congressional opposition.

On 5 December 1972, the Office of the Secretary of Defense (OSD) Program Budget Decision reduced the FY programmed procurement of F-14s from eighty-eight to fourty-eight aircraft.[Ref. 45] This purchase under Lot V was received by Grumman with a refusal to honor the existing contract without a price increase. Grumman said they had lost $85 million on the program already and would lose $105 million more if they did not get a price hike.

In similar contract disputes, the Pentagon had acceded to contractor demands by rewriting the contract completely or ordering system modification that increased the contract price. In the case of the F-14, the Navy was denied this kind of choice. Congressional pressures had mandated only enough money for the purchase of fourty-eight aircraft according to original contract prices.[Ref. 46] The Defense Department was forced to announce it would hold Grumman to the originally contracted price on December 11, 1972.

There was support for the F-14 in Congress as well as the opposition. A Congressional bailout of Grumman was being maneuvered in the House and the Senate by the New York Congressional representatives. New York Senators Javits and

Buckley announced on the 13th of December 1972, that they would propose legislation in 1973 to permit Grumman of Bethpage, New York, a higher price for F-14's. Similar action would be forthcoming from the four New York Congressmen Grover, Leat, Wydler and Roncallo. President Nixon was supportive of the move to assist Grumman.

Following intensive negotiations between Grumman and the Navy, Grumman agreed to produce the fourty-eight aircraft in Lot V at the originally contracted price provided Congress authorized and appropriated necessary funding for a new contract in fiscal year 1974.[Ref. 47]

The F-14's cost in constant 1969 dollars when the program began was $9.7 million per aircraft. Changes in the contract were authorized after Lot V, which led eventually to F-14 costs escalating to $17.9 million per unit by 1981. [Ref. 48]

The new F-14 program manager, Captain Leonard Snead, countered Congressional critics and started building support for the program with an aggressive public relations program. Every time the Congress would try another ploy to kill the program, the program office would make a ten minute film showing off the aircrafts many attributes. Senator Proxmire continued his assertions that the F-14 was nothing more than a "Gold Plated" mistake that should be canceled. The battle continued but the bottom line was the Navy began accepting

delivery of F-14s. The Navy had its new generation aircraft for fleet protection.

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APPENDIX B (CASE STUDY TEACHING NOTE)

TOMCAT ACQUISITION

All of the questions should be asked of the class studying the F-14 case study. Never give out all of the answers until the class has had the chance to give all of the answers themselves. In certain cases there are no correct answers. These questions are inserted in order to stimulate thought and conversation.

1) What is a Mission Needs Statement (MNS)?

a) Have a student write their Navy F-14 MNS on the board and assess it for:
   1) Is it broad or narrow in scope?
   2) Does it address a specific item or does it present the threat that needs to be countered by a new weapon system. An MNS addresses the threat, not the platform to counter the threat.

b) Have a student write down their Air Force MNS on the board and assess it for items 1) and 2) above.

2) Did both Services have a well developed concept of what threat existed and what they needed? Explain your idea. (A judgement discussion type of question with no correct answer).

3) SECDEF McNamara had a need to fulfill. What was it? (Have the student list the motives behind McNamara's actions).

a) Initiate discussion on how our U.S. Democratic society makes decisions that effect the DOD.
   1) Executive Branch
   2) Legislative Branch
   3) Judicial Branch
   4) Checks and balances
   5) Which branch does the Air Force and Navy fall under?

b) Extending the definition of a MNS, what was SECDEF McNamara's MNS?
   1) Limit discussion here. Idea is that SECDEF can be an ally or a threat to the users' need satisfaction.

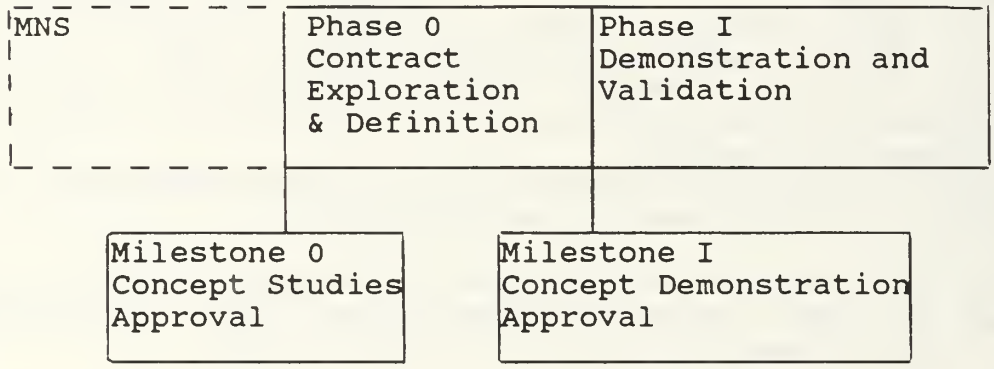
c) What role does the media play in decisions made in the United States.
   1) Can polarize public opinion and effect Congress:
   - Media stories about bad operating characteristics of the Navy's F-111.
   2) Have the class list where the media helped or hurt public opinion and affected Congressional decisions:

   Also list the following items:
   -Bad angle of window on F-111 making carrier landings hazardous.

-F-111 was too heavy and too large for safe landings and parking. (Use an overhead projector).

4) When the Navy openly sought alternatives to the F-111 by awarding contacts to McDonnell-Douglas and Grumman, what modern phase of the procurement cycle would the procurement have been in?

a) The answer is: The Demonstration & Validation Phase, Phase I
b) Prior Phases and milestones gone through to get to this stage are:?



5) Discuss the idea of an "unsolicited proposal."

a) Legal requirements.
b) Did the Government do "the right thing" by taking other unsolicited proposals?

6) Were there any ethical considerations that came out during Grumman's unsolicited proposal?

a) Grumman brought an old friend of the Admirals to the proposal meeting.
b) Grumman may have had an organizational conflict of interest.

7) Grumman stated that none of the proposed F-14 aircraft systems surpassed current state of the art?

a) Question. Define state of the art? (Surpass current technology)
1) What risk is avoided by not surpassing the state of the art. (Technology risk)
2) Was the state of the art actually surpassed? (Probably in the area of titanium fabrication).

8) Captain Lionel Ames was designated as the F-14 program manager. What were his priorities?

a) Make up lost time (6 years) from F-111.
b) Get a quick RFP on the street for contractors.
c) Why are RFP's issued?
    1) When competition is desired to keep costs low.
    2) To define for the contractors exactly what the Government expects to receive.

9) What would the DOD 5000 series goals be for the program manager, Captain Ames?

a) The Service branch representative is responsible for planning, developing, and acquiring the system.
b) The program manager represents NAVAIR to the contractors.
c) The program manager is responsible for transforming the MNS into the RFP.
d) The program manager must control all risk:
    -Cost risk
    -Schedule risk
    -Performance risk
    -Supportability for the life time of the system

10) What areas were stressed in the case study and which ones were not, as compared to the DOD 5000 series of current program manger requirements?

a) Cost was not as big of a concern.
b) Supportability was not as big of a concern.
    1) Supportability of the TF-30 engines and the AWG-9 avionics package was a perineal problem throughout the life time of the F-14.

11) The SECDEF had changed by this time but if McNamara had still been the SECDEF, what could have gone wrong between the SECDEF and the program manager?

a) The failure of the F-111 for the Navy resulted from a SECDEF who wanted his own mission needs stressed above those of the program manager. If the two are not working together, survival of a weapon system is doubtful.

12) Five contractors responded to the RFP during the original solicitation. (See page 7 of case study). What ethical/legal violations by todays standards occurred during the solicitation for the F-14?

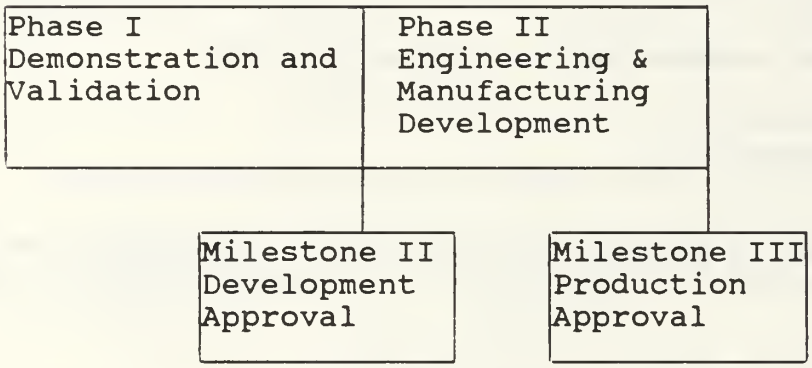
a) Technical transfusion. During the course of the discussions with the offerors the Navy gave "hints" or tips as to what they wanted. These tips made the five separate offerors proposals become more and more alike.

13) When the field of five manufacturers was narrowed down to Grumman and McDonnell-Douglas, what phase of the current

contracting DOD 5000 series phase do you believe the contract was in?

a) Just passed through milestone II, entering into Phase II, Engineering and Manufacturing Development.
b) Have class discuss the reasons behind their choice.

-Narrowed field to two possible competitors from earlier large field of five competitors.



(Tie in question 14 with above drawing)

14) Why was competition still being used?

a) List class answer
-Competition is best way to keep costs down and prevent contractor from maximizing profits.

15) What source selection critera should the Government use to get the best contractor?

a) This entire list should go on an overhead after the class input has been put on the board:

- Whether the contractor's proposals effectively meet the MNS.
- Cost of development should be compared, along with Life Cycle Costs (LCC).
- Manning and training requirements.
- Spare part support and what level of reliability is expected.
- Maintainability and supportability in the fleet.
- Safety requirements.
- Contractor's past performance.
- Contractor's facilities are evaluated. Are they adequate, or can they become adequate?

- Contractor's technical capabilities and production requirements.
- Contractor's management skills and expertise.

b) Which of these traits appears to have been stressed in the case study, and which ones were not? (List Yes or No with felt tip on the overhead transparency)

c) What is a best value purchase? (Government gets the most it can for the dollars it expends, do not award on price alone)

1) Was the F-14 a best value buy?
(Rhetorical question for discussion, no exact answer)

2) Ask for a show of hands, then have someone give Pro's and Con's, and explain their choice.

Pros(Yes F-14 was best Value) Con

16) In relation to the current Cost Accounting Standards (CAS) 401 and 402, what errors were made in the F-14 case.

a) Redistributing overhead costs during the proposal
b) Have the class answer the question, (Was Grumman trying to "Buy In" to the F-14 program?)

1) After the discussion, point out that officially, "buying in" was never proved.

c) On page 8 of the case study, a reference is made to the Navy's independent estimate of costs. When does the Government make an Independent Government Cost Estimate?

-Whenever an exact price is unknown or must be forecasted.
-During price analysis and cost analysis to assess the Government's position that it will try to achieve during contract negotiations.

17) The winner of the competition, Grumman, agreed to a Fixed-Price-Incentive-Firm (FPIF) Contract. Why was this type of contract used?

a) The Government wanted to prevent the contractor from spending all the money it could to build an aircraft. The risk is on the contractor to control costs in a Fixed-Price-Incentive type of contract.
b) What are the essential number for using an FPIF contract?

-Target Cost (TC) = $352 Million
-Target Profit (T Profit) = $ 35 Million
-Target Price (TP) = $387 Million
-Share ratio Gov/Contr = 70/30
-Ceiling Price (CP) = $440 Million

c) What is the formula for Point of Total Assumption (PTA)?
$$PTA = CP - \frac{(TC + T\ Profit)}{Gov\ Share\ Ratio} + TC$$

d) What is the formula for profit at PTA?
Profit at PTA = CP - PTA

c) Have an overlay of the graph for these figures.

18) What are the advantages of a Multi-Year Procurement (MYP)? (Point out that the original F-14 contact was for eight years)

a) The contractor can buy tools; he knows he has a firm cash flow for a period of time.
b) The contractor will be more inclined to invest in his plant and equipment.
c) Labor and material can be managed more efficiently, because the stability exists with a MYP program.

What are the disadvantages of a MYP?

a) Inflation can not be forecasted.
b) Market trends are hard to forecast.
c) Trade union actions can are unpredictable.

What was the aircraft industry going through in the late 1960's and early 1970's?

a) Viet Nam was over, so the demand for military aircraft was down.
b) The NASA push to put a man on the moon was over, this directly affected Grumman.
c) With the demand for aircraft down, overhead rates rose, requiring layoffs and other cost cutting efforts.

19) Schedule risk, and its control, can impact a major weapon procurement. What was done to control schedule risk in the F-14 procurement?

a) The Government used the VARLOT system (as seen in table 1 it means "variable lot size") when they told Grumman a minimum, median and maximum amount of aircraft they would be ordering over the eight years of the contract.

1) Does the idea of a VARLOT purchase forecast compare or contrast with the stability desired in a MYP?
-Contrast. The stability sought is somewhat negated. When Grumman was forecasting their own purchases to coincide with the VARLOT system, they had a wide area for error in ordering. Grumman was required to control cost or risk losing money. Changes of this kind, even with a one year notice,

effect the "through put" or production flow of Grumman. They can not make efficient production runs or batch purchases in this environment. The changes can cause cost increases of items if Grumman over orders materials and under produces F-14's. It is also very hard for Grumman to change contracts it has with its sub-contractors. They may have an inefficiency thrown into the equation because they have to store a lot of subcontractor delivered items that they won't use in production.

b) The Government chose to use the first six production aircraft as test aircraft. What was the Government trying to control?

-Cost risk and schedule risk are involved with the use of a "Prototype aircraft". Prototype procurement takes longer than the method chosen for the F-14 and cost more. Prototypes do remove a lot of production risk because the prototype must be accepted before entering production.

-"Concurrent Scheduling" of Navy test and evaluation of the F-14 during production phase had schedule and cost risk involved. -If an aircraft has a problem the schedule can be adversely affected.

20) What types of incentives came out in the case study?

a) Aircraft weight controls.
b) The following were also incentivised, but not portrayed in the case study.
-Aircraft carrier approach speed
-Acceleration time and altitude
-Maintainability

21) In the area of risk controls in the case study, what areas were overlooked or not addressed?

a) Inflation (Forecasted at 2% to 3% per year on material and labor). No adjustments for inflation were to be allowed for the first six years of the contract. (Lot VI).
b) Ceiling price was to be kept constant for eight years.
c) Forecasts on market trends were not very good.

22) Was there a contract change clause? What were its provisions?

a) YES. It provided for payments to the contractor in cases where the Government initiated the change. Contractor changes had to be incorporated at no cost to the Government.
b) What problems were brought on by this change clause? F-14 changes would require expensive retro-fits for aircraft that were produced without the changes.

23) What is Government Furnished Equipment (GFE)?

a) The Government will furnish systems built by other prime or subcontractors to the prime contractor, for installation into the aircraft.
b) What were the GFE items in the F-14 case?
-Engines
-Avionics
-Weapon System
c) What type of risk is placed on the Government with GFE?
-If GFE is delivered late, a Government change will have been initiated and the Grumman could collect claims because the Government adversely affected their schedule.
d) Would a claim like this have to go to court to be settled?
1) NO. The Contracting Officer could make an "equitable adjustment" for the delay. The Government and the contractor would both have to agree on the amount of adjustment and the Government would pay Grumman that amount.

c) Although not identified in the case, the Government had set up a "Liquidated Damages" requirement in the contract. This included:
-Slips in delivery would cost Grumman $5,000 per aircraft per day, not to exceed $3,000,000 total.

24) Was the TF-30 engine a "risk free" item of GFE?

a) YES and NO. YES because it was already being produced for the F-111. NO because it had under power and stall problems already diagnosed in the F-111 program.
b) How did the Navy try to control the risk involved with the TF-30 engine?
1) Instructed the engine manufacturer, to design a better engine.
2) Navy thought they could piggy-back on the Air Force program to build a better jet engine.
c) The Navy had no plan in place if the TF-30 engine program failed. Did the Navy have a "Competitive Strategy" to control the risk involved by using the TF-30 engine? Why or why not?
d) Why was the TF-30 rushed into use for the F-14 program despite its short comings?
1) URGENCY. The MNS justified quick procurement because of the Soviet air threat. Urgency of need when justified, is an appropriate decision.

26) Grumman is responsible in sharing risk with the Government and controlling that risk. Did Grumman take any risk that the Government would like to have known about?

a) Yes. Subcontractor bids were not formalized before Grumman made it's bid on the F-14. This is not unusual,

Grumman may not have won the F-14 contract if it had waited for firm bids from all subs. The risk associated with a fixed-price contact for multiple years increased due to unforeseen market changes such as demand going down for aircraft after the Viet Nam war ended and inflation growing to unexpected proportions.
b) Bad forecasting due to inflation and labor price increases for aircraft workers after the Viet Nam War should have been addressed. The phenomenon of a shrinking military after the end of a war is not new.

27) Did Grumman take any steps to control cost risk after the award of the F-14 contract?

a) Reduced overhead by reducing employment from 31,500 in 1969 to 25,300 in 1971.
b) Reduced physical plant square footage by 630,000 square feet.
(Both verified by NAVAIR audit team)

28) When Grumman accurately figured their losses during the first two years of the F-14 contract, what legal alternative did they have to get Government help to prevent bankruptcy?

a) They could have invoked the use of Public Law 85-804, Extraordinary Contractor Relief. Use of this law would allow Grumman to receive Governmental assistance to prevent bankruptcy and assist them in keeping a good cash flow. If the Contracting Officer and Congress approve invoking this law, it would have allowed the Government to circumvent some regulations to help the contractor from going out of business with items like advanced payments.
b) Congress terms this a "Bail Out" of the contractor in certain instances.

29) Captain Ames was replaced as the F-14 program manger by Captain Leonard Snead. What reasons necessitated the removal of Captain Ames?

a) Technical problems with TF-30 engines.
b) F-14 not performing to specification because of under powered operations with the TF-30 engine.
c) Grumman appeared to be in trouble, losing money. Why didn't the Navy see this coming?

30) Was replacing Captain Ames the "right thing to do."

a) This is a discussion question, there is no right answer.
b) Discuss points such as:
-P.M. is responsible for the procurement program.
-Victim of time and circumstance.
-Congress wanted penance for what they conceived as bad

management of F-14 program due to problems that had turned up during production.

31) Congressional fears of the F-14 were manifested by:

a) Reducing purchase numbers in 1972 from eighty-eight to fourty-eight aircraft. Done by the Office of the Secretary of Defense due to Congressional pressure.
b) Grumman initially refused to deliver any more aircraft under the current contract. They did this because they had lost $85 million dollars to date on the contract and to take the 1972 order for fourty-eight aircraft would result in the loss $105 million dollars by reducing their planned output by fourty aircraft.
c) Congress would not allow the Navy to change the contract in 1972. They were forcing the Navy to enforce the contract as is, even though Grumman would suffer another loss.
d) Certain Congressional representatives considered the F-14 as little more than another "Gold Plated" aircraft that could not do the job it was originally designed for.

32) Congressional support for the F-14 existed. Who were the supporters?

a) Grumman was located in New York so the Congressmen and Senators from New York were a natural source of support that the Navy could depend on.
b) When Grumman accepted the loss of $105 million, they got support for a contract change before the next production work began.
c) Congressional support finally fell in favor of allowing Grumman to renegotiate the F-14 contract at the five year point in 1974 vice waiting for the originally contracted eight year period.
d) Then changes that came about changed the unit cost of the F-14 from $9.7 million to $17.9 million dollars each.

33) Class discussion on the advantages of prototypes, an extension of the "Fly-before-you-buy" idea originated during the F-14 procurement by Under Secretary Packard.

a) List advantages and disadvantages of prototypes.
b) Advantages:
-Produce a proven aircraft,
-Expensive changes and back fit programs can be avoided
c) Disadvantages:
-Lengthens the Engineering and Manufacturing Phase of the contract
-Early costs of the contract are greater then they would be without a prototype.

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